POLICY GUIDELINES FOR BIRD RINGING IN HIMACHAL PRADESH

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Wildlife Wing

Himachal Pradesh Forest Department

Policy guidelines for bird ringing in Himachal Pradesh

Front cover: Blue-Whistling Thrush (a ringed individual)

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FOREWORD

India has the honor of being one of the 17 mega-diverse countries of the world, a permanent or temporary home to several species. The evolution of this biodiversity over the last 3.5 billion years has left a lasting impact on our behaviour and culture. India's developing economy is however quickly evolving from a largely agrarian culture to a more diversified one, putting increasing strain on land use.

The development and its impact have led to a realization in the gaps in scientific research, knowledge about the ecology and conservation status of a large proportion of species, including a whole suite of avian species. Long term monitoring with the highest scientific standards, inclusive and multi sectoral collaborations and involvement of the community at large is a pressing need. The coordinated Bird Ringing program targeting all avian species, a pioneering initiative of the Himachal Pradesh Forest Department (HPFD) is thus a timely and welcome effort.

It is known that bird ringing produces data on a bird's survival, life history events and migrations, which aids in an improved understanding of the dynamism in populations. In today's time this may also provide essential information on emerging diseases and their impact on populations and environmental health.

In 2017, the Chief Minister, in his budget speech recognised the need for scientific studies especially related to the species diversity of the state, which can be replicated in other locations, and announced the establishment of an Avian Monitoring and Bird Ringing Station at Pong Dam Lake Wildlife Sanctuary. In lieu of this, the Himachal Pradesh Forest Department has put together the first Policy Guidelines For Bird Ringing In Himachal Pradesh to guide the implementation of long-term bird ringing and monitoring in the state. This document will help institutionalize science-based bird ringing run on a long-term basis; enabling the outcomes to inform conservation management.

The Policy Guidelines for Bird Ringing In Himachal Pradesh is a comprehensive document that provides a direction and framework for the implementation of the long- term bird monitoring program in the Western Himalaya which shall benefit regional bird conservation, contribute to national biodiversity targets and fulfil the obligations set out by the international treaties. The document will certainly create a positive influence in the national and global conservation efforts. This publication will undoubtedly be an important tool for conservation of birds and their habitats, and it will demonstrate the need for international cooperation and continuous and increased collaboration amongst all stakeholders at the global level.

I extend my congratulations and my best wishes to the Himachal Pradesh Forest Department, the implementation team, and all the partners and collaborators.

(Onkar Chand Sharma)

Rufous sibia © Santosh Thakur

Rajiv Kumar, IFS
Pr. Chief Conservator of Forests (Wildlife)
& Chief Wildlife Warden, HPFD

PREFACE

I am elated to present the 'Policy guidelines for bird ringing in Himachal Pradesh'. Himachal Pradesh (HP) lies within the western Himalaya and is an important region along the Central Asian Flyway migratory route. The birdlife of Himachal Pradesh includes more than 660 species of resident and breeding species which winter further south in other Indian states, as well as, wintering birds which breed in the Himalaya and a range of countries to the north and the west, mainly from Central Asia but some as far as the middle East or even Sweden.

To highlight the states' importance and commitment for bird conservation long-term, systematic and coordinated Bird Ringing program targeting all avian species (especially passerines) at select locations (where ringing stations are proposed to be established) across Himachal Pradesh. It is also pertinent to highlight that this is a pioneering initiative of the state forest department and is probably the first for India.

I thank all the contributors for drafting this policy guidelines which provides a road-map and methods to institutionalize science-based bird ringing run on a long-term basis; enabling the outcomes to inform conservation management decisions within Himachal Pradesh, and possibly other regions.

This document describes the background to bird ringing, the objectives of the HPFD bird ringing, infrastructural, administrative and managerial requirements, technical aspects of bird ringing, code of ethics and future perspectives. The protocols described here are drafted following extensive review of publications prepared as part of century-long ringing programs in Europe and North America, and consultation with experts involved in these schemes. The goal of this document is to provide a framework for establishing a long-term ringing program in the western Himalaya which shall benefit regional, national and global bird conservation.

I am sure that the policy guidelines contributed to the collection of systematic long-term data which should serve as a basis for understanding Indian birds, their populations and their conservation.

(Rajiv Kumar)

Long tailed shrike © Santosh Thakur

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The 'Policy guidelines for bird ringing in Himachal Pradesh' is an outcome of several years of systematic efforts of the Wildlife Wing, Himachal Pradesh to formalise bird ringing as a conservation activity. The capacity building workshops in bird identification, handling and ringing which were held annually from 2013 to 2018 provided the technical know-how in formulating the policy guidelines.

The then incumbent Principal Chief Conservator of Forests & Head of Forest Force, Principal Chief Conservator of Forests & Chief Wildlife Warden, Chief Conservator of Forest (North and South), Divisional Forest Officers (Great Himalayan National Park, Pong Dam Lake Wildlife Sanctuary and Sarahan Pheasantry) provided the much needed guidance and support for organising these workshops.

The bird ringing experts from Game and Wildlife Conservation Trust, United Kingdom and British Trust for Ornithology, United Kingdom consented to be the resource person and professionally trained the frontline staff of the Himachal Pradesh Forest Department in various aspects of bird ringing. The workshops were pioneering such an initiative was the first across undertaken by the Wildlife Wing, Himachal Pradesh Forest Department.

The fruition of the years of efforts in the form of this policy document to support long-term monitoring program through bird ringing at strategic locations across Himachal Pradesh was led by Shri Rajiv Kumar, Principal Chief Conservator of Forests and Chief Wildlife Warden and Shri Anil Thakur, Additional Principal Chief Conservator of Forest (Hq). The drafting of these guidelines was carried out by Shri Sat Pal Dhiman, Shri Lakshminarasimha R and Dr Francis Buner Game and Wildlife

Conservation Trust, United Kingdom.

Shri Ashwin Vishwanathan and Shri Praveen J from Bird Count India, Dr Monika Kaushik, Assistant Professor, Azim Premji University, Bengaluru provided inputs were always available for discussion on the final draft of the policy guidelines. Technical inputs during the drafting of these policy guidelines were provided by Dr. Dan Hoare, Director of Conservation, Butterfly Conservation and British Trust for Ornithology Permit-A ringer, Mr. Tim Walker.

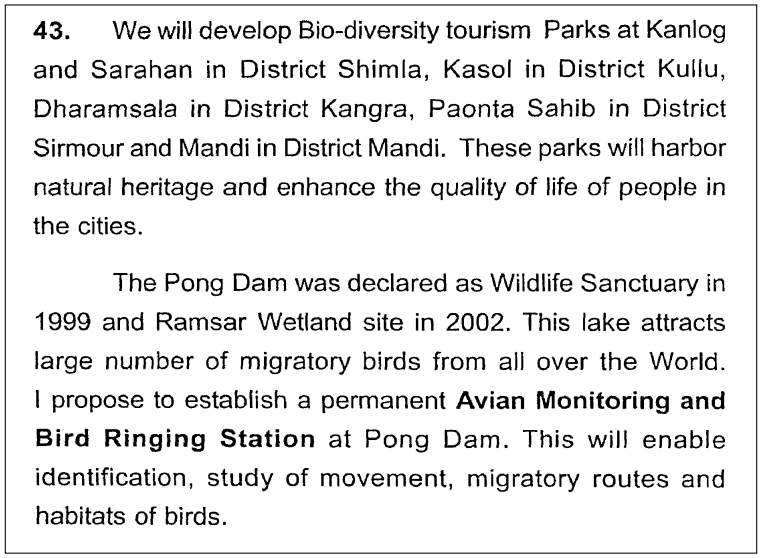
The participants in the all the bird ringing workshops deserve a mention for their diligent attendance and for being the first batch of professionally trained bird ringers who will lead the Himachal Pradesh Forest Department Bird Ringing program.

1 Preamble and Scope

More than 12% of the worlds' birds occur in India, including 61 endemic species. More than 660 bird species (over 50% of the total birds found in India) are reported from Himachal Pradesh. However, knowledge about the ecology and conservation status of most of these species remains limited due to the lack of adequate ornithological research and monitoring. To address this, the need for a state-level program for scientifically managing and conserving birds in Himachal Pradesh has been envisioned. To achieve this, a comprehensive avian monitoring program based on highest scientific standards is necessary. In this context, it is proposed to establish *Bird Ringing* as a regular monitoring activity across the state of Himachal Pradesh, as this provides the means to study large numbers of birds with a direct management and conservation benefit.

The precedence for this policy guidelines to commence bird ringing as a long-term conservation activity in Himachal Pradesh is the *budget announcement* by the Hon'ble Chief Minister of Himachal Pradesh to establish an **Avian Monitoring and Bird Ringing Station** at Pong Dam Lake Wildlife Sanctuary, Himachal Pradesh, in the 2017 budget speech (excerpt in Figure 1).

Bird ringing is an internationally accepted scientific technique used widely and successfully across the world for the management and conservation of birds. Several million birds are ringed annually as part of organized ringing and monitoring programs worldwide (e.g. more than 4 million (1 million=10 lakhs) bird ringed annually across Europe), the results of which have been applied in the successful conservation of single species, species-groups, breeding, wintering and stop-over habitats and



43. We will develop Bio-diversity tourism Parks at Kanlog and Sarahan in District Shimla, Kasol in District Kullu, Dharamsala in District Kangra, Paonta Sahib in District Sirmour and Mandi in District Mandi. These parks will harbor natural heritage and enhance the quality of life of people in the cities.

The Pong Dam was declared as Wildlife Sanctuary in 1999 and Ramsar Wetland site in 2002. This lake attracts large number of migratory birds from all over the World. I propose to establish a permanent **Avian Monitoring and Bird Ringing Station** at Pong Dam. This will enable identification, study of movement, migratory routes and habitats of birds.

Figure 1: Excerpt from the 2017 Chief Minister's Budget Speech (page 22) announcing the establishment of an Avian Monitoring and Bird Ringing Station at Pong Dam Lake Wildlife Sanctuary.

sites across the world [1]. The focus to date has been on the American and the African/West Eurasian flyways. These have been studied for over 100 years already, with recent advances in the East Asian/Australasian flyway. Among the major global flyways, the Central Asian Flyway remains the least studied and understood migratory route.

Bird ringing in India was initiated in 1959 by the Bombay Natural History Society (BHNS) under the supervision of Dr. Salim Ali. Since then, BNHS has regularly carried out bird ringing at various locations across India. Given the geographic extent of India, the number of birds ringed (around 0.4 million birds ringed during 1959-2000 by BNHS) is extremely low in comparison to other nations, especially Europe and North America where ringing (or banding as it is called in North America) is a regular government-supported activity. In the United Kingdom alone, almost 1

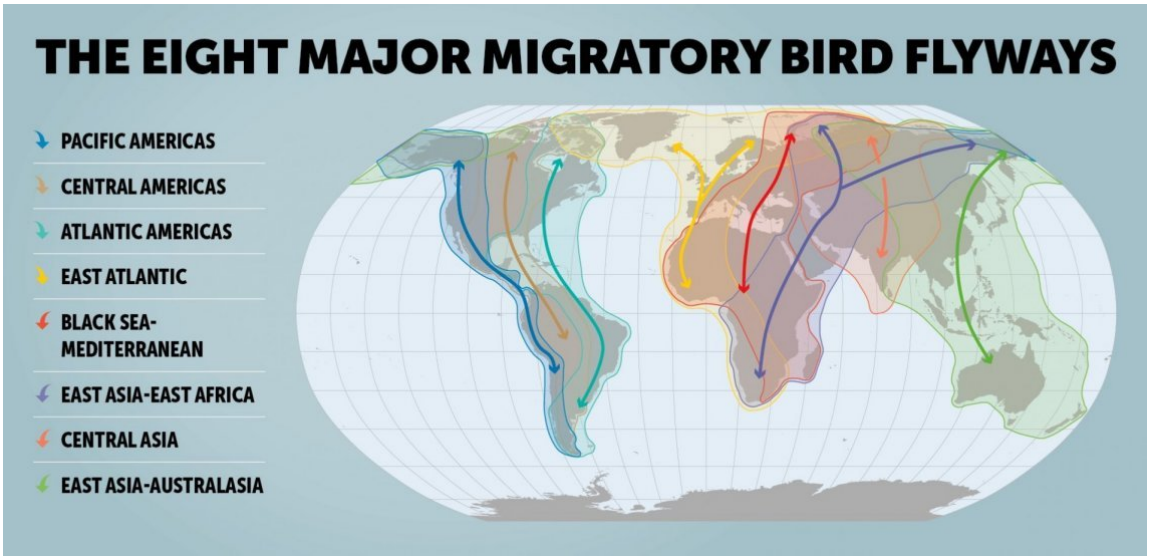


Figure 2: Major migratory bird flyways of the world (From BirdLife International)

million birds are ringed annually by 2600 volunteer ringers. It is also known that small-scale bird ringing does not yield significant results as compared to long-term schemes run in Europe and North America [2]. This is perhaps why there is so much we still do not understand about the migration, movement and demographics of India's birds, all invaluable information required for effective conservation.

Himachal Pradesh (HP) lies within the western Himalaya and is an important region along the Central Asian Flyway migratory route (Figure 2). The bird-life of Himachal Pradesh includes resident and breeding species which winter further south in other Indian states, as well as, wintering birds which breed in the Himalaya and a range of countries to the north and the west, mainly from Central Asia but some as far as the middle East or even Sweden [3, 4]. This highlights HP's importance and responsibility for bird conservation in the Indian and international context. BNHS has carried out bird ringing at only two locations in Himachal Pradesh, and at a

comparatively very small scale, focused on a small proportion of non-passerine species only. For ringing data to have significant conservation benefit, it should be science-based and run in the long-term as only such studies can provide essential information on population trends and drivers of demographic change [5]. Therefore, appreciating the states' regional and international importance for the conservation of resident and migrating birds, the Himachal Pradesh Forest Department (HPFD) proposes a long-term, systematic and coordinated ***Bird Ringing program*** targeting all avian species (especially passerines) at select locations (where ringing stations are proposed to be established) across Himachal Pradesh. This long-term bird ringing program will be run to the same standard as similar schemes in Europe and North America. It is also pertinent to highlight that this is a *pioneering initiative* of the state forest department and is probably the first for India.

As a starting step, HPFD has conducted six annual capacity building workshops (2013–2018) for its staff in bird ringing. As part of these workshops, the forest department staff were trained by licensed bird ringing experts from the British Trust for Ornithology (BTO), United Kingdom. During these workshops (held at Sairopa, Great Himalayan National Park, Nagrota Surian, Pong Dam Lake Wildlife Sanctuary and Sarahan), nearly 2000 individual birds of over 100 species were ringed; and over 40 HPFD personnel were professionally trained in bird handling and ringing. These workshops were also attended by BNHS personnel, national and international volunteers.

At this point, the HPFD intends to institutionalize science-based bird ringing run on a long-term basis; enabling the outcomes to inform conservation management

decisions within Himachal Pradesh, and possibly other regions. This document has been prepared to guide the implementation of long-term bird ringing in Himachal Pradesh.

This document describes the background to bird ringing, the objectives of the HPFD bird ringing, infrastructural, administrative and managerial requirements, technical aspects of bird ringing, code of ethics and future perspectives. The protocols described here are drafted following extensive review of publications prepared as part of century-long ringing programs in Europe and North America, and consultation with experts involved in these schemes. The goal of this document is to provide a framework for establishing a long-term ringing program in the western Himalaya which shall benefit regional, national and global bird conservation.

2 Background

Across India, more than 1300 bird species have been reported to date of which 84 are globally threatened [6]. Of these, 61 are endemic (native) to the Indian sub-continent which includes 17 globally threatened species. 467 Important Bird and Biodiversity Areas (IBA's) have been identified in India by Birdlife International. With 417 migrant bird species (283 landbirds, 134 waterbirds and 51 soaring birds), India is amongst the top 50 countries in the world with the highest numbers of migratory species (with regular native occurrence when breeding, non-breeding or on passage) [7].

To address the large-scale loss of species and ecosystem damage across the world,

a comprehensive global agreement, the Convention on Biological Diversity (signed at the Earth summit in Rio de Janeiro in June 1992), was adopted encompassing all aspects of biodiversity conservation. The Convention, to which India is a signatory, affirms, in addition to the sovereign rights of nations over their biological resources, three main goals: a) the conservation of biological diversity, b) the sustainable use of its components, and c) the fair and equitable sharing of the benefits from the use of genetic resources. As a mandate of being a party to the convention, India prepared a National Biodiversity Action Plan (NBAP) to strategise and integrate conservation and sustainable use of biodiversity into nation-level actions and policies in accordance to the goals of the CBD. Subsequently in 2010, a 10-year broader action plan, Strategic Plan for Biodiversity 2011-2020 including Aichi Biodiversity Targets, in support of biodiversity was adopted by all the parties of the CBD. Following the adoption of this strategic plan, India developed 12 National Biodiversity Targets (NBT) along with indicators for monitoring, using Aichi targets as a framework. These international treaties and the corresponding national targets highlight many aspects of bird conservation. NBT-6 specifically points to the need for the development of effective management and conservation measures in ecologically representative areas of India. This includes monitoring: a) status and management of Important Bird and Biodiversity Areas (IBA), b) occupancy and population trends of threatened species, species richness in IBA's, and c) sites visited by migratory species. India's recent report provides an outlook of the progress towards these international biodiversity targets.

Additionally, to support the conservation of migratory species, India has adopted

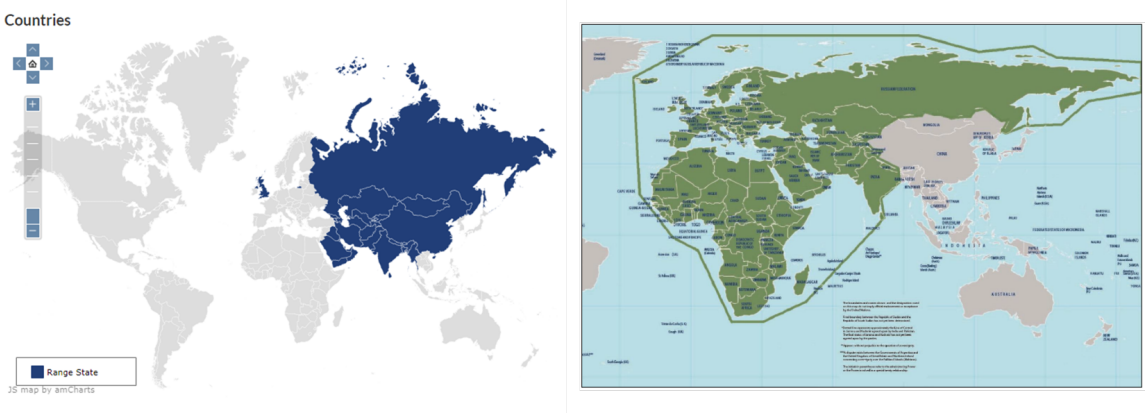


Figure 3: Range countries of the Central Asian Flyway Action Plan and African-Eurasian Migratory Landbirds Action Plan

the Convention on Conservation of Migratory Species of Wild animals (CMS). The Central Asian Flyway Action Plan for the Conservation of Migratory Waterbirds and their Habitats has been adopted by India as part of this treaty in 2005. The Central Asian Flyway Action Plan sets the agenda for enhanced regional environmental cooperation among the Central Asian Flyway states to promote the conservation of migratory waterbirds and their habitats. To specifically address landbird conservation, an African-Eurasian Migratory Landbirds Action Plan is in place employing a coordinated flyway-scale approach for the protection of African-Eurasian migratory landbirds (see Figure 3) .

The proposed *HPFD Bird Ringing* program will contribute to the national biodiversity targets and fulfill the obligations set out by the international treaties signed by the Indian government by generating long-term bird monitoring data and subsequently aiding conservation efforts.

2.1 Himachal Pradesh

Himachal Pradesh is situated in the north-western Himalayan ranges of India, a Globally Important Bird Area (IBA, BirdLife International 2016). There are six major forest types in Himachal Pradesh: Tropical Dry Deciduous, Sub-tropical Pine, Subtropical Dry Evergreen, Himalayan Moist Temperate, Himalayan Dry Temperate, and Sub-alpine and Alpine. Himachal Pradesh is a stronghold for the distribution of many western Himalayan bird species. More than 650 bird species have been recorded from the state.

Himachal Pradesh lies in the Western Himalayan Endemic Bird Area (EBA 128). Ten of the 11 bird species endemic to this EBA are recorded in Himachal Pradesh. They are: Western Tragopan (*Tragopan melanocephalus*), Cheer Pheasant (*Catreus wallichii*), Brook's Leaf Warber (*Phylloscopus subviridis*), Tytler's Leaf Warbler (*Phylloscopus tytleri*), Kashmir Flycatcher (*Ficedula subrubra*), White-cheeked Tit (*Aegithalos leucogenys*), White-throated Tit (*Aegithalos niveogularis*), Kashmir Nuthatch (*Sitta cashmirensis*), Spectacled Finch (*Callacanthis burtoni*) and Orange Bullfinch (*Pyrrhula aurantiaca*). Twenty-seven IBA's have been identified in Himachal Pradesh by BirdLife International (see Figure 4).

3 Bird Monitoring

One of the key approaches to assess the human impacts on nature is ***monitoring***. Monitoring involves measuring the changing state of populations of species. Analysis of species' trends obtained through robust scientific monitoring can provide valuable

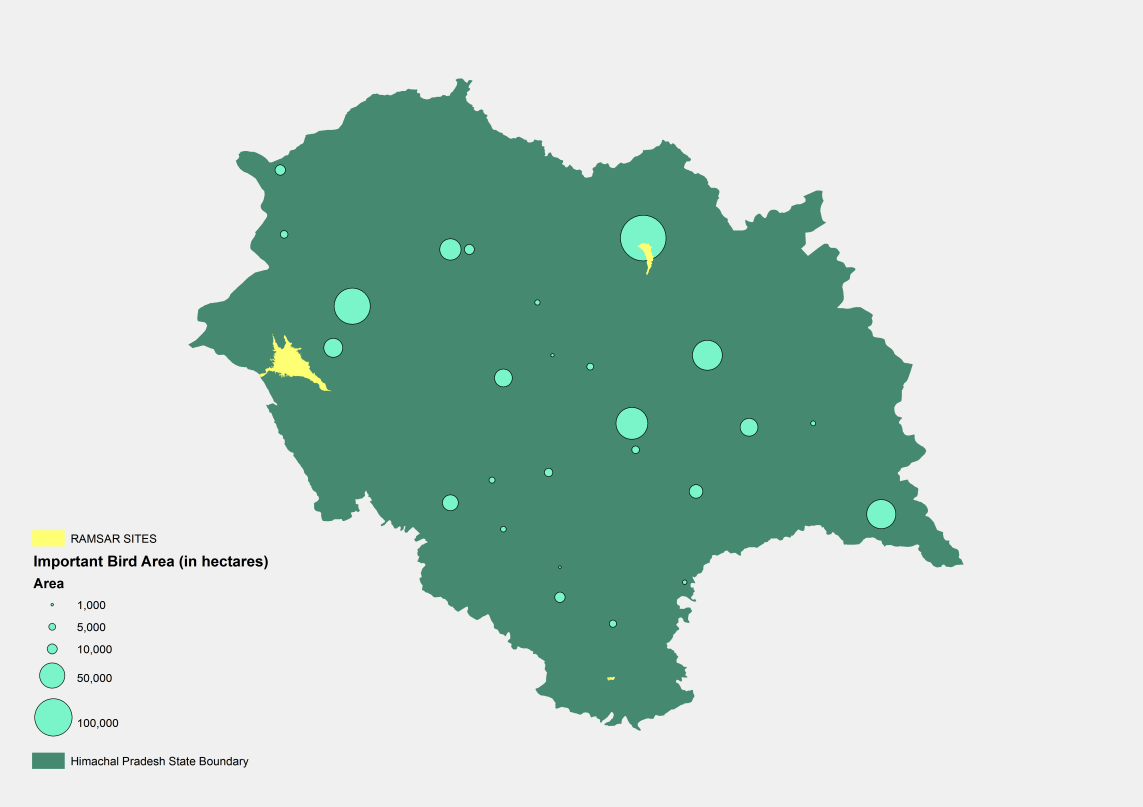


Figure 4: Distribution of Important Bird Areas in Himachal Pradesh.

insights on the long-term persistence of species. The objectives to monitor species can broadly be classified into two categories, which often complement each other: a) scientific objectives aimed at understanding the behaviour and dynamics of the monitored system, and b) objectives aimed at acquiring information useful in making informed management decisions.

One commonly monitored taxonomic group is birds, because: a) they are good indicators of environmental change, b) they are relatively easy to census in comparison to mammals, reptiles or any other taxonomic group, and c) they are attractive and hence draw participation from a large number of amateur naturalists and the

general public.

Across the world, large-scale bird monitoring programs previously have and continue to provide vital information on the ecology of bird species. Such data has been helpful to identify species at risk and the factors that limit their numbers, suggest and help evaluate management approaches, and document recovery of species across their distributional range.

Bird ringing, widely considered as one of the most cost-effective and efficient ways of large-scale bird monitoring, is a vital tool that contributes greatly to our understanding of bird populations and their conservation [8]. It can provide insights into aspects of avian biology such as demographic structure, breeding success and movements, that are not possible by other monitoring methods. At larger scales, bird ringing provides estimates of bird populations and reveals population changes and helps prioritize conservation actions. Bird ringing allows to understand migratory routes of birds and the dangers they may encounter on their annual journeys. Bird ringing has emerged as one of the most popular and powerful methods for studying populations of wild birds across the world while promoting citizen science at the same time, which is the impetus behind proposing the *long-term Bird Ringing in Himachal Pradesh*. For all these reasons, bird ringing is therefore embedded in national legislations in the form of Permanent Ringing Schemes in the vast majority of developed countries.

4 Bird Ringing

Bird ringing is the practice of marking birds by placing a lightweight, uniquely numbered metal ring around a bird's leg (typically less than 0.1% of the bird's body weight). This is a scientifically proven technique and provides a reliable and harmless method of identifying birds as individuals. Data from recapture of ringed birds has been helpful to identify species at risk together with pinpointing the factors that limit population growth, suggest management approaches that bring about species recovery, document population changes, and evaluate species recovery across their distributional range.

The first systematic efforts at bird ringing dates back to 1899, when Hans Christian Cornelius Mortensen, a Danish schoolmaster, produced the first aluminium bird rings inscribed with a unique number and address, which he then attached on water birds and some hawks close to his house. This innovative approach allowed permanent marking and individual identification of birds without any harm and enabled their movements and other life history traits to be recorded over time.

Figure 5: A ringed Yellow-eyed Babbler (*Chrysomma sinense*) at Pong Dam Lake Wildlife Sanctuary

Systematic and large-scale ringing schemes are ongoing across various countries in Europe, North America and Africa. Bird ringing was initiated in North Amer-

ica in 1902, Europe in 1909 and Africa in 1948 [9, 5]. Over decades following the establishment of these long-term ringing programs, millions (10 lakhs = 1 million) of birds belonging to a wide range of species have been ringed and re-captured (e.g. In Europe, as on 1995, over 110 million birds have been ringed and 1.8 million recoveries reported; with around 4 million birds ringed every year with 90,000 ringed birds recovered annually) providing valuable data for the conservation of many bird species [1].

5 HPFD Bird Ringing – An overview

The HPFD Bird Ringing Scheme is envisioned as a long-term monitoring program to carry out bird ringing at strategic locations across Himachal Pradesh with active involvement of forest department staff, researchers, scientific organizations and people interested in bird conservation. Long-term bird ringing by HPFD aims to promote conservation-oriented research that contributes to the understanding of population changes by monitoring the survival rates, breeding productivity, dispersal and migration of a wide range of bird species; from Indian breeding birds, passage migrants, altitudinal migrants, Indian breeding birds that may winter abroad and non-breeding long distance migrants for which India provides safe wintering habitats. The results from bird ringing also have an important function in contributing to other aspects of avian science, particularly studies of behaviour, moult, body condition and taxonomy. Importantly, through the monitoring of bird populations, bird ringing will help the state and central government to achieve national biodiversity targets and fulfill

commitments to international treaties (CMS, Central Asian Flyway Action Plan). This program also complements the bird ringing efforts by the Bombay Natural History Society (BNHS) carried out across other Indian states.

The HPFD Bird Ringing Scheme shall be funded and managed primarily by the Wildlife Wing of Himachal Pradesh Forest Department. As part of this program, it is envisioned that three permanent ringing stations will be established at select locations across Himachal Pradesh in a phased manner. The HPFD Bird Ringing Stations are planned to be placed in a strategic way to record vital information on as wide a range of breeding and migratory birds of Himachal Pradesh as possible. The priority locations for establishing ringing stations should preferably be: 1. Pong Dam Lake Wildlife Sanctuary, a Ramsar wetland having large numbers of migratory and resident breeding birds. *A permanent ringing station has now been established at Nagrota Surian, Pong Dam Lake Wildlife Sanctuary, a Ramsar wetland having large number of migratory and resident breeding birds.* 2. an alpine pass used by a significant number of migrating birds crossing the Himalayas from Central Asia to India and back, and 3. a location which is ideal to monitor altitudinal migrants from the higher Himalayas to the foothills. Eventually, an additional two permanent ringing sites are proposed to be established considering the criteria described above and adaptively incorporating knowledge obtained from the station established at Pong Dam. These sites will be selected following intensive reconnaissance surveys and trial ringing sessions to ascertain that the sites will help in achieving the goals of the HPFD Bird Ringing Scheme.

The ringing activities of HPFD Bird Ringing program will be carried out at

HPFD designated bird ringing stations only, like the one established at Pong Dam Lake Wildlife Sanctuary. However, special projects of HPFD (such as the previously undertaken Sparrow Ringing Project in Shimla) can be carried out elsewhere in HP following approval by the Chief Wildlife Warden. The HPFD ringing stations shall make efforts to collaborate with national/international organizations with specialised experience in bird conservation, ringing and monitoring to provide scientific backing to the planned activities including raising the profile of bird ringing in Himachal Pradesh. A specially constituted Technical Group (see section 6) by the Government of Himachal Pradesh will oversee, provide scientific directionality and ensure high standards to the ringing program in Himachal Pradesh. The ringing stations will be managed by professionally qualified and licensed staff and will offer opportunities to individuals to learn bird ringing and handling techniques. A certification process developed as part of these policy guidelines will allow people to carry out supervised or independent bird ringing at HPFD ringing stations. The systematic long-term data collected as part of this should serve as basis for understanding Indian birds, their populations and their conservation.

5.1 Justification for the HPFD Bird Ringing

5.1.1 Conservation implications of bird ringing

Bird ringing data is useful in both research and management projects. Individual identification of birds enables studies of dispersal and migration, behaviour and social structure, life-span and survival rate, reproductive success and population growth. The data generated from bird ringing at the newly established permanent bird ringing

station can be applied in the conservation management of Pong Dam Lake Wildlife Sanctuary thorough the following means:

i. Providing knowledge about movements of birds – e.g., establishing migration routes; finding links between breeding and wintering grounds; delineating separate populations; tracking range expansions and colonisations; measuring dispersal within populations; quantifying gene exchange among populations;

ii. Estimating demographic parameters and determining dynamics of bird populations – e.g., estimating annual production of young birds or age-dependent annual survival rates; building models of population dynamics for predicting extinction probabilities; separating population sources and sinks; comparing survival rates of experimental or rehabilitated birds to those of wild birds;

iii. Ecological research requiring individual recognition – e.g., estimating territory size, habitat selection, dominance hierarchies, moult patterns, or parasite burdens of individuals; examining importance of migrant stop-over areas through individual stop-over times and weight gains;

iv. Monitoring populations and individuals – e.g., monitoring Endangered or Threatened species; identifying populations declining from decreased reproductive output or from diminished recruitment; establishing population trends and validating other techniques of population monitoring;

v. Toxicology and Disease Research — e.g., sampling for prevalence of diseases; turnover time assessments to determine the potential exposure of birds to chemicals in contaminated areas, studies related to zoonotic diseases etc.

vi. Educating the public about science and birds – e.g., teaching about birds, their movements, their plumage differences, and how moult proceeds; reinforcing stewardship responsibilities, create enthusiasm for nature conservation and appreciation of biological diversity.

vii. Detect and understand changes in long-distance and altitudinal migration patterns and behavioural changes in response to climate change [10].

5.1.2 Other collateral benefits

In addition to the above mentioned conservation implications, some specific management implications that bird ringing offers on a short- and long-time scale are listed here:

Short-term benefits are:

i. Provides information about the number of species present.

ii. Regular bird ringing effort at a particular site provides information about the number of individuals of each bird species occurring in that area -Species Richness and Encounter Rates.

iii. Provides information about wintering, passing migrants and resident breeding birds, including seasonal information about nesting, hatching and fledging.

iv. Birds in the hand allow close-up observation and better information about field identification features.

v. Practising bird handling techniques.

Long-term benefits are:

i. Estimation of bird populations based on recapture data (mark-recapture framework)

ii. Detection of changes in demographic trends of different bird species

iii. Monitoring the effect of management interventions on bird populations

iv. Providing information on migratory strategies including arrival and departure times, stop-over sites and migratory routes

v. Setting of conservation priorities based on detected population trends

vi. Understanding of habitat use by birds based on capture locations

vii. Improved knowledge of bird ecology

viii. Improved knowledge of moult strategies and ageing of Indian birds (e.g. [11], [12])

ix. Disease monitoring for improved understanding of local bird movements to help prevent spread of diseases and the planning of appropriate interventions

5.1.3 Capacity building

Bird ringing at the HPFD-run permanent ringing stations will allow important capacity building for the following aspects:

i. Bird ringing provides an ideal opportunity to improve handling techniques for various species of birds under safe and controlled conditions.

ii. Improve bird identification skills to aid field recognition and bird monitoring generally.

iii. The Forest Department will be able to professionally assess external research proposals which include bird capture or bird handling. In addition, researchers or students working on specific bird research projects may benefit from learning bird ringing as part of the proposed program.

iv. The trained staff of the H.P Forest Department will directly be involved in running the ringing program. This will facilitate easy institutionalization of the proposed ringing program.

5.1.4 Collateral benefits

Collateral benefits of HPFD long-term bird ringing are:

i. A significant contribution to the national and international conservation targets and agreements.

ii. This policy should serve as an inspiration and baseline reference for other Indian states interested in initiate bird ringing as a conservation activity.

iii. Focussed studies carried out as part of the ringing program can help to investigate effect of management interventions in relation to habitat improvement (e.g. assessing species richness and abundance through regular ringing in a habitat patch before and after a management intervention, such as a planned plantation).

iv. Imparting bird education and creating conservation awareness on a regional scale.

v. Raise the profile of the sanctuary through attracting international ornithologists and bird ringing volunteers at the ringing station.

6 Administration and Management

6.1 Administrative aspects

a. The geographic ambit of the guidelines described here is the political boundary limits of the state of Himachal Pradesh.

b. Currently, as only one bird ringing station is run by Himachal Pradesh Forest Department, the protocols described here mainly refer to the management of the Avian Monitoring and Bird Ringing Station at Nagrota Surian, Pong Dam Lake Wildlife Sanctuary. As additional ringing stations are established, these protocols may require review and amendments according to local circumstances.

c. The operational framework of long-term bird ringing program in Himachal Pradesh will follow Indian Wildlife and Environment protection laws viz. The Wildlife Protection Act (1972), The Environment Protection Act (1986), Biological Diversity Act (2002), Forest Conservation Act (1980) and The Indian Forest Act (1927), and any other relevant wildlife/environment laws and International treaties to which the Indian Government is party to, including Convention on Biological Diversity, Convention on the Conservation of Migratory Species of Wild Animals,

African-Eurasian Migratory Landbirds Action Plan and Central Asian Flyway Action Plan.

d. The stakeholders of HPFD Bird Ringing Scheme include:

- Himachal Pradesh Forest Department, its Wildlife Wing and staff
- Subsidiary societies of HPFD (e.g. Pong Lake Biodiversity Conservation Society, Himachal Pradesh Zoos and Conservation Breeding Society) or other departments of the Himachal Pradesh Forest Department
- Bombay Natural History Society and its subsidiary organizations primarily involved in activities related to bird capturing and ringing across India
- Nodal organizations for bird ringing identified by MoEFCC *viz.* Salim Ali Centre for Ornithology and Natural History, Wildlife Institute of India and Bombay Natural History Society.
- Indian/international, government/non-government/privately run academic/scientific institutions, universities and organizations
- International collaborators involved in HPFD bird ringing capacity building workshops such as Game and Wildlife Conservation Trust, United Kingdom and licensed ringing experts from British Trust for Ornithology.
- Scientists, research personnel and students
- Other Indian states, and their respective governments and forest department
- Indian/International bird enthusiasts
- HPFD Ringing Station personnel of Himachal Pradesh

e. The overall administrative control of the HPFD Bird Ringing program lies with the Wildlife Wing, HPFD. Its main functions with reference to the implementation of long-term bird ringing in Himachal Pradesh are:

   - To supervise the operation and implementation of the HPFD Bird Ringing program under this policy through the technical group constituted by the Government of Himachal Pradesh;
   - To oversee the annual planning operation related to Bird Ringing;
   - To create necessary infrastructural, managerial and financial support to ensure long-term success of bird ringing program in Himachal Pradesh;
   - To facilitate bird ringing certification of individuals involved in ringing at HPFD designated bird ringing stations.

f. The functioning of the *Avian Monitoring and Bird Ringing Station* established at Pong Dam Lake Wildlife Sanctuary will be overseen by Divisional Forest Officer -cum- Wildlife Warden, Wildlife Division, Hamirpur.

g. Wildlife Wing of the Himachal Pradesh Forest Department has long-term professional experience in the wildlife management. But, the *HPFD Bird Ringing Scheme*, a novel and pioneering initiative of the Wildlife Wing is a conservation science activity requiring *specialised* professional expertise and skills for its implementation. Therefore, to ensure that this program is implemented as envisioned and fulfilling its full potential, it is essential to collaborate with national and international scientists, research personnel and students with extensive experience

in bird ringing. It is pertinent to mention here that during the capacity building workshops HPFD collaborated with The Game and Wildlife Conservation Trust, United Kingdom and licensed ringers from British Trust for Ornithology for HPFD staff in bird ringing. The ringing trainers are experts in bird ringing studies of western Palearctic birds and also many Indomalayan birds that winter in the Paleartic, and hence HPFD may consider continuing collaboration with these organizations for the foreseeable future to ensure that the goals of the bird ringing are achieved. Furthermore, HPFD will actively promote collaboration with other suitably qualified national and international organisations or professionals in the discipline of bird ringing or ornithology more generally, to achieve the goals of HPFD Bird Ringing program.

h. The ***Technical Group*** overseeing the HPFD bird ringing program shall comprise of the following members:

   (a) Principal Chief Conservator of Forests - cum - Chief Wildlife Warden, H.P – Chairman

   (b) Additional PCCF/Chief Conservator of Forests (Forest Headquarters) – Member

   (c) Chief Conservator of Forests (North) – Member

   (d) Divisional Forest Officer (Hq. Wildlife), Dharamshala – Member

   (e) Representative from Salim Ali Centre for Ornithology and Natural History, Tamil Nadu – Member

   (f) Representative from Wildlife Institute of India, Dehradun – Member

(g) Representative from Bombay Natural History Society – Member

(h) Francis Buner (Game and Wildlife Conservation Trust, U.K.): International bird ringing expert and collaborator for bird ringing capacity building workshops organized by Wildlife Wing, HPFD during 2013-2018 – Member

(i) Sat Pal Dhiman, Advanced trainee in bird ringing capacity building workshops organized by Wildlife Wing, HPFD during 2013-2018 – Member

(j) Lakshminarasimha R, Advanced trainee in bird ringing capacity building workshops organized by Wildlife Wing, HPFD during 2013-2018 – Member

(k) Ringer In-charge of all HPFD-run bird ringing stations – Member

(l) Divisional Forest Officer (Hamirpur Wildlife Division) – Member Secretary

i. The Technical Group shall periodically (preferably annually) to discuss improvement to the process, both ethical and scientific. The specific functions of the *Technical Group* are:

- To supervise, monitor and coordinate the activities of the HPFD Bird Ringing program;
- To provide scientific directionality to the HPFD Ringing Scheme and and to ensure that the professional standards match those of other long-term schemes across the globe;
- To prepare an Annnual Plan of Operation (APO) for approval by the Wildlife Wing, H.P Forest Department through Wildlife Division, Hamirpur;

- To identify research avenues in bird conservation that involve bird ringing (specific for Pong Dam or other regions in the state);
- To prepare and finalize the annual report of ringing activities;
- To oversee bird monitoring at Pong Dam Lake Wildlife Sanctuary;
- To act as an internal Animal Welfare and Ethics group to ensure and assess standards of bird handling as part of HPFD Bird Ringing program.

j. The ongoing capacity building program in bird ringing of the Wildlife Wing shall continue to offer advanced bird ringing training to previously taught participants and also aim to train additional staff in bird ringing in order to ensure that international standards are met. The capacity of the staff will also be built by the FD to impart training through workshops on latest analytical techniques to interpret ringing data. This will also ensure continuous availability of trained manpower within the Wildlife Wing having requisite skills to professionally run the HPFD bird ringing program on long-term basis. See Appendix G for the list of trainers and advanced trainees with their experience level.

k. Funding and financial management: The establishment and implementation of the HPFD Bird Ringing Scheme shall be funded primarily by the Wildlife Wing, Himachal Pradesh Forest Department. The department shall endeavour to create a separate budget line for bird ringing in Himachal Pradesh or alternatively provide funds available for wildlife conservation under relevant CAT plans. The HPFD funding shall cover the infrastructural costs including ringing station establishment, equipments and recurring expenses associated with bird ringing (for

instance: the maintenance of the ringing building and its surrounding grounds [especially for protective fencing of the mist-netting areas its maintenance, any habitat management targeted at improving the suitability for wintering and breeding birds within the premises of the ringing site], accommodation costs for ringers working at the ringing station, including food expenses). However, during the functioning of the Avian Monitoring and Bird Ringing Station at Pong Dam Lake Wildlife Sanctuary, securing external funding (e.g research grants, donations, funds from other state departments or national agencies etc.) shall be attempted. The external grants/funding shall be accepted through the Himachal Pradesh Zoos and Conservation Breeding Society for further allocation to augment *HPFD Bird Ringing* program. This will augment available finances and facilitate expansion the HPFD Bird Ringing Program.

l. Timing of Bird Ringing: The HPFD Bird Ringing Stations will initially carry out ringing mainly for a minimum of five months in each calendar year. The ringing sessions will be timed to match the arrival and departure of migrant species. The sessions will comprise of two months of ringing in early spring (mid-January to mid-March, mid-April the latest) and three months of ringing in autumn (mid-September to mid-December). These sessions may be extended/shortened in response to the climatic conditions and annual variations in migration. Ringing sessions for the rest of the calendar year may be carried out to address specific management objectives upon seeking appropriate approvals or recommendation of the Technical Group. This may include special projects such as monitoring breeding success of key species (e.g. waders), teaching trainees techniques of ring-

ing pulli (nestlings)/geolocator/radio-tracking/satellite tracking studies to understand migratory routes of wintering birds (similar to ongoing Bluethroat study). The proposed timing of ringing also ensures that encounter rates of very young birds is minimal.

m. The ownership of the data generated as part of the *HPFD Bird Ringing Program* and monitoring efforts at HPFD Bird Ringing Stations lies with the Himachal Pradesh Forest Department, including its intellectual property rights. See item 2c for more details regarding the sharing of data.

6.2 Infrastructure

1. Avian Monitoring and Bird Ringing Station: A state-of-the-art Avian Monitoring and Bird Ringing Station has been established at Nagrota Surian, Pong Dam Lake Wildlife Sanctuary. The station consists of a ringing room, library & laboratory, store and restroom (Figure 6). The design of the centre was decided based on inputs from international bird ringing experts and considering the local conditions. The station is envisioned to be run as a *Constant Effort Site* (see [13]) which implies that in addition to the building itself, habitat patches should be developed around the station to ensure optimal capture rates. Four different types of habitats are identified (see Appendix A) in the vicinity of the ringing station which should be managed scientifically (based on inputs from the technical group) to complement functioning of the centre. Further, as an integral part of management, it has to be ensured that the identified habitat patches remain free of stray cattle, feral dogs/cats and human disturbances,

which in future might necessitate the installation of a livestock and dog-proof fence around the entire ringing site and its permanent maintenance.

Figure 6: Avian Monitoring and Bird Ringing Station at Nagrota Surian, Pong Dam Lake Wildlife Sanctuary

2. Equipment: Bird ringing requires specialized equipment to ensure that birds are captured, handled and released safely. The following is a broad list of equipment required for the functioning of the centre:

   - Mist Nets: The key points to consider while selecting mist nets are:

     (a) Mesh size: The mesh sizes used are differentiated depending on the species for which the effective use of the net is intended. For small passerines, the mesh size most in use is 16 or 17 mm (see Figure 8).

It is small enough even for mass catching of Goldcrests. Smaller sizes (14-15 mm) have lower catching ability. Sixteen millimetres mesh net has lower catching ability when bigger birds are involved (the size of thrushes or larger). In contrast, many small birds (such as Leaf Warblers) could easily pass through 18 mm mesh. Small birds will usually get much more entangled when caught in such a net. It is therefore recommended to use 16 mm mesh size if passerines are the target species, despite some small or slim bodied birds can pass through of them.

When setting mist nets to catch mid-sized waders, ducks, rails, turns and gulls, it is recommended to use a 30 mm mesh. For small waders, an 18mm mesh-sized net is commonly used around the world. Mist nets for capturing species such as waders, work best during the night. Nets set during the day often remain visible owing to lack of background cover. Therefore, when catching during daytime, one or two-shelf nets should be mainly used. Alternative methods for capturing waders are described in [14].

(b) General points: As a standard, black nets should be used. For general passerine mist-netting, four-five shelve nets should be used. For open grassland birds such as larks and pipits, but also waders (see above), one or two shelf nets should be used. The potential danger of the net to birds should be treated as one of the most important characters when net types are chosen. This feature is strictly connected with the

thickness of the thread, which is characterized by the *denier* measure (weight in grams of 9000 meter thread) and the "ply" (the number of threads twined), e.g. 50d/2, 70d/2, 110d/2, 235d/2 etc.

Thinner thread means lower visibility of the net, better catching ability, higher degree of entangling of birds (they are difficult to remove – the time spent on removing will be longer), and ultimately much higher probability of skin and feather damage to birds. In addition, there will be more holes made by twigs, thorns or heavy birds caught, as well as lower UV resistance and greater laboriousness of net cleaning. Thicker thread, in turn, means lower catching ability of the net. However, birds are not entangled and are easier to remove, thus, saving time. With such nets, beginners are less likely to injure the bird. Cleaning the thicker net from leaves is much simpler and the procedure is safe for the net. Nets of this kind also have high durability because there will be fewer holes caused by entangling of bushes and catching heavy birds. In addition, the netting has much higher UV-resistance. It is therefore recommended that nets with thicker threads are used at all HPFD bird ringing stations, unless supervised by well trained ringers, and the station routine includes studies that mandate the use of such nets.

- Bird Transport and Storage Devices: The basic way of transporting and storing passerines during ringing is a linen bag closed with a soft string that could be hung up on a special hanger at the chest of the ringer,

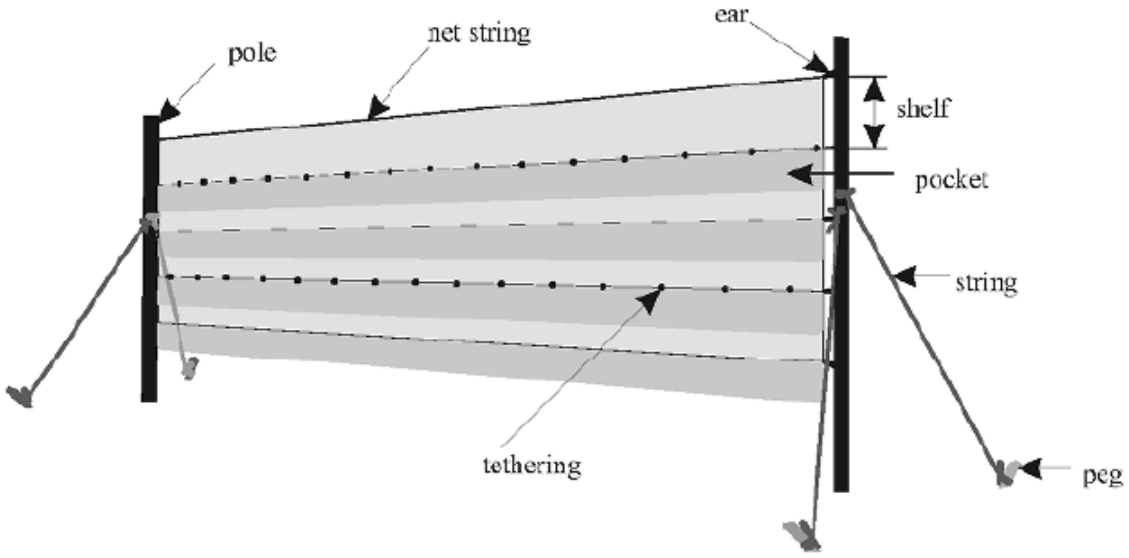


Figure 7: A mist-net used for capturing birds during ringing.

on a binocular, which is a very convenient solution, if the person is not simultaneously the passing birds observer, or, in the worst case, on a forearm, but not carried in the hand (see Figure 9). The most important thing when preparing bags is to use linen that allows for the passage of air. Cotton bags usually have been washed before first use for removal of chemical apertures. Cotton bags easily absorb water from excrement and moist birds. Such bags should be dried as they are more likely to be damaged by microorganisms when moist. Bags should be regularly washed and in the meantime cleaned from droppings and feathers. Bags of different sizes need to be available at all times in suitable numbers to

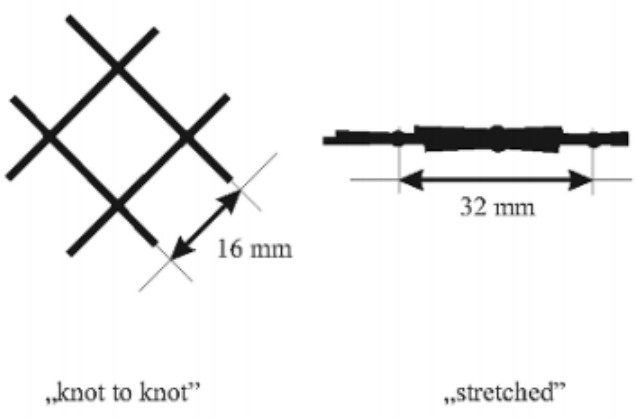


Figure 8: Standards for measuring mesh size.

ensure smooth running of capture and processing operation. The inside of bags must be free of loose threads where birds can get entangled.

- Laboratory tools: See Figure 10 for a a broad list of equipment.
- Bird Processing Table: The bird processing table (Figure 11) may be different from that described here according to logistics and expected number of the birds caught, but ultimately, they should be comfortable for people and birds.

  The bird processing table should be fitted with two or three comfortable seats, and a table that allows convenient writing in notebooks for many hours without a break. Along the walls of the ringing room rows of hooks for bird bags should be fixed; the distance between each hook should be large enough that the bags do not press against each other. One of the rows should be within hand reach of the ringer. When the weather

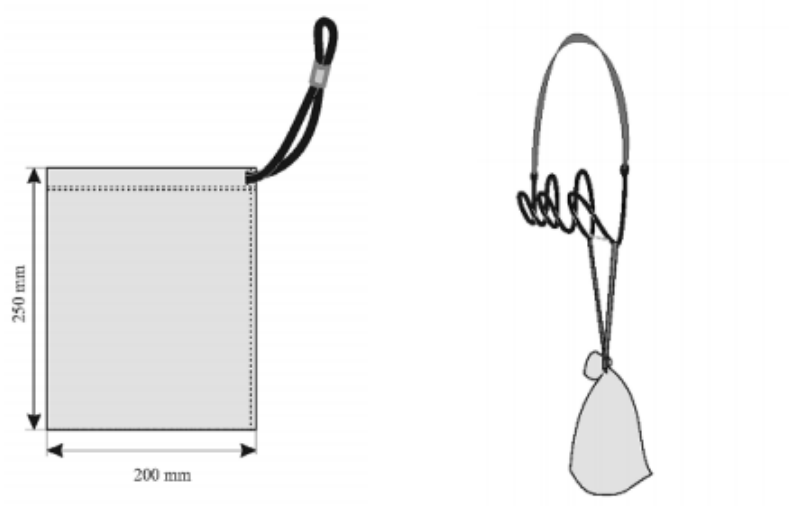


Figure 9: Bird bag and hanger for transporting bird bags. Size represented here is for smaller passerines only. Bags of appropriate sizes should be used for larger birds.

is warm enough and not too windy, the best solution is to have the bird processing table in the open, but under a tarpaulin roof protecting against rain and direct sun. Only very temporary bird processing tables could be unsheltered. In lower altitudes, a shade is necessary. An advantage with the open-air ringing is that the bird can be let free without delay when it has been handled, and if it escapes, it can fly freely without hitting a window. The material of the roof should be of neutral colour (white or grey) and preferably half-transparent since good light will facilitate sexing and ageing based on subtle colour characters.

- Books and literature: As a start, the following books should be available at the Pong Avian Monitoring and Bird Ringing Station. Efforts to expand the collection with relevant books should be made consequently. Copies

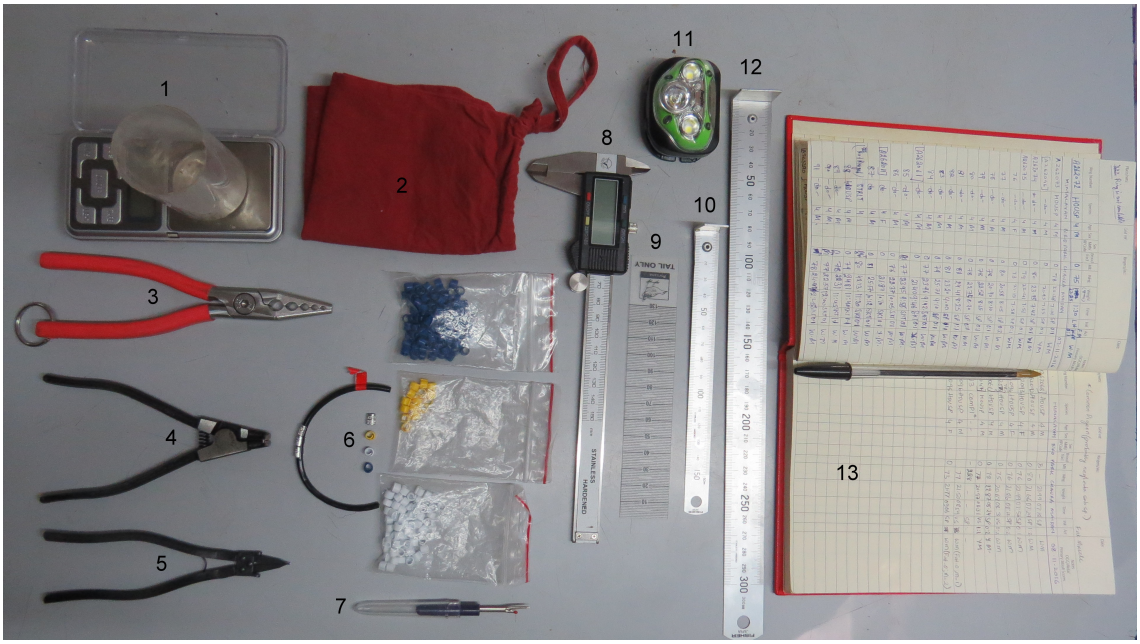


Figure 10: Laboratory tools. 1. Weighing scale and cup for placing the bird, 2. Bird bag, 3. Ringing Plier, 4. Circlip Plier (Large), 5. Circlip Plier (Small), 6. Colored plastic and metal rings, 7. Quick-un-Pic (for cutting strands of netting), 8. Calipers, 9. Flexible and translucent tail rule, 10. Wing rule with stop (Small), 11. Torch, 12. Wing rule with stop (Large), 13. Ringing data book.

of bird ringing and monitoring related literature should also be made available at the centre.

(a) Bird Ringing - A concise guide: British Trust for Ornithology [15]

(b) Bird Ringing Station Manual: Przemysław Busse, Włodzimierz Meissner [14]

(c) Identification guide to European passerines: Lars Svensson [12]

(d) Identification guide to European non-passerines: Kevin Baker [16]

(e) Identification guide to birds in the hand: Laurent Demongin [17]

(f) Birds of the Indian Subcontinent: India, Pakistan, Sri Lanka, Nepal,

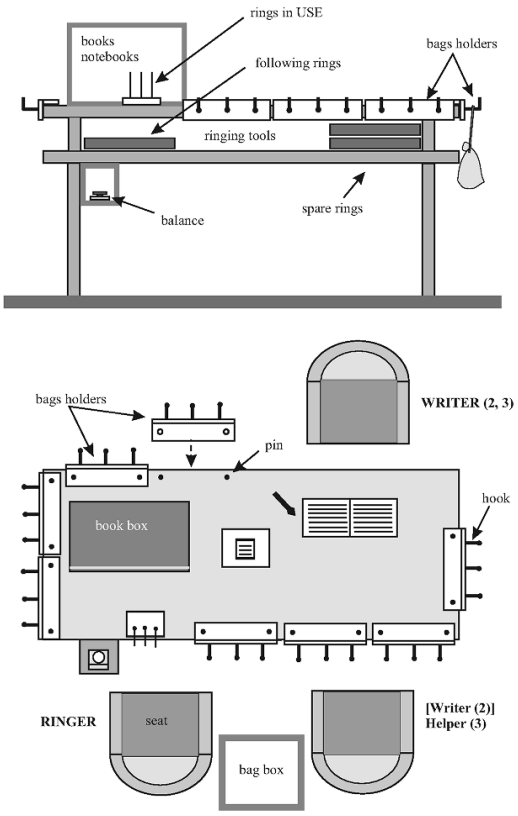


Figure 11: A fully equipped and optimally organized Bird Processing Table. Image is only for representation purposes. It can be adapted to local circumstances to fit conditions and convenience. At most European ringing stations birds awaiting processing are stored on hooks along the wall behind the ringing table.

Bhutan, Bangladesh and the Maldives: Richard Grimmett and others [18]

(g) Pipits and Wagtails of Europe, Asia and North America: Per Alstrom [19]

(h) Advanced Bird ID Handbook: The Western Palearctic: Nils van Duivendijk [20]

6.3 Organizational structure and Staffing

6.3.1 Organizational structure

See Figure 12.

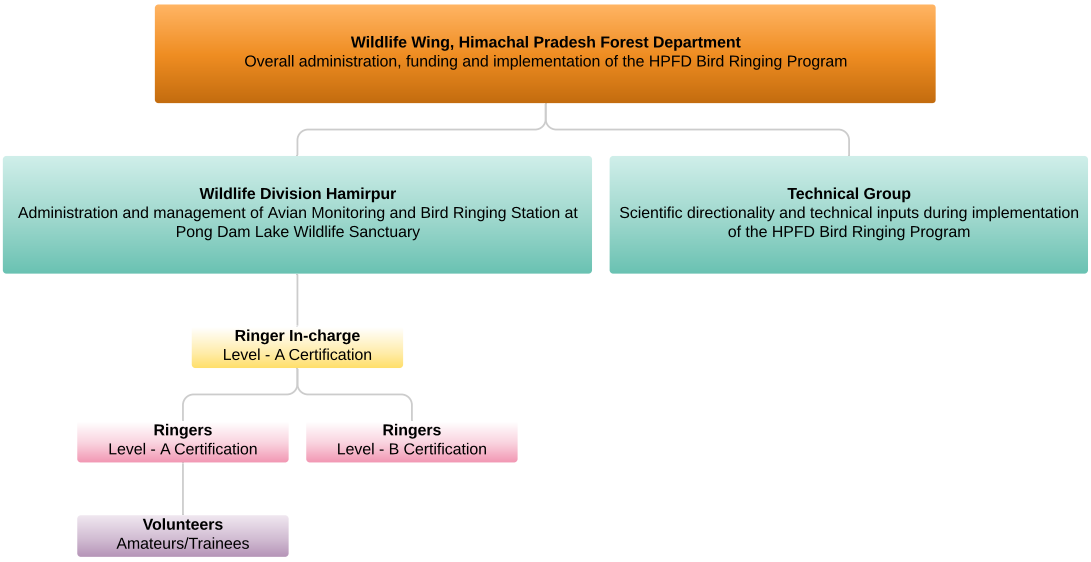


Figure 12: Organizational structure of the HPFD Bird Ringing Program.

6.3.2 Staffing

Optimally, each ringing session at HPFD-run ringing station should comprise of around 10 individuals comprising of:

1. Ringer-in-charge (with mandatory Level-A certification/long-term ringing experience): To oversee the functioning of the ringing station on scientific lines and ensure highest level of welfare standards. Two advanced trainee

Wildlife Guards should be posted to run the centre and carry out routine activities in close coordination with permanent Ringer-in-charge. One of these Wildlife Guards can be made Ringer-in-charge of the centre till such a time a permanent Ringer-in-charge is hired. Eventually, it shall be aimed to appoint a permanent ringing station in-charge (department staff or hired staff) with a minimum Master's degree qualification in Life Sciences and relevant ornithological research experience to oversee the functioning of the Avian Monitoring and Bird Ringing Station. Recommendation letter from the experts is annexed at Appendix H.

Specific responsibilities of the ringer-in-charge include:

- Supervise ringing session including setting up of nets, extraction, processing including recording morphometrics, ringing and release, data entry and database management, while ensuring professional standards of ringing, animal welfare and adherence to the protocols;
- Preparation of reports at the end of each of ringing session;
- Analysis of data and information dissemination by means of popular articles and peer-reviewed publications;
- Assist in ringing certification process;
- Management of habitat including appropriate interventions identified to be developed as a Constant Effort Site (see Appendix A).

2. Certification Level-A holders (including forest department staff and/or other ringers) (see section 7 for details on certification): a minimum of 1 ringers.
3. Certification Level-B holders (including forest department staff and/or other

ringers) (see section 7 for details on certification): a minimum of 2 ringers.

4. Volunteers: As per requirement and scope of the ringing exercise.
5. Ringing Assistants: The ringing assistants role is to help with all ringing site logistics that do not involve bird handling, such as help set up nets under supervision, carry bird bags, clean bird bags, help with food logistics, etc.: a minimum of 2 Ringing Assistants.

6.4 Database management

A strong database management system should be developed to manage, access and share data related to bird ringing and monitoring generated under the purview of *HPFD Bird Ringing Scheme*. The goal is to ensure that the data is accessible by scientists and managers for use in science-based conservation management at regional and international scale. As with previous sections, the points described here mainly refer to the ringing station at Pong Dam Lake Wildlife Sanctuary, and this hence may have to be amended consequently as the scale of HPFD bird ringing is expanded and additional ringing stations are established. The key aspects of that should be considered during the creation of a database management system for the HPFD Bird ringing are:

(a) Infrastructure: A centralized system of digitizing the data generated from ringing sessions (including photographs) at the Pong station and old ringing records should be created. For this purpose, a dedicated computer has to be made available with good internet access and storage space (a mini-

mum of 10 TB Desktop storage on a server) at the Pong Avian Monitoring and Bird Ringing Station. The old records from ringing by BNHS and other organizations should be digitized and stored here. Suitable cloud locations should be made available for online data backup.

(b) Data management and software: Similar to long-term ringing schemes in Europe and North America, a software should be developed (through technical collaboration with an experienced software firm) for entering and managing bird ringing data. Various examples (North American Ringing Scheme[1], European Ringing Scheme[2]) for the structure and management of such a software is available. The software developed for managing HPFD Bird Ringing scheme data should be developed using the framework used by these countries for managing decades of ringing data.

(c) Data sharing: Sharing of ringing data is a common practice as part of various ringing schemes (North American Ringing Scheme[3], European Ringing Scheme[4]). This will encourage and enable, advanced analysis of ringing data for application in the conservation management of birds regionally. A system for sharing information with scientists, organizations (governmental and non-governmental) and institutions specializing in bird conservation and research for advanced analysis of ringing and recapture information should be developed (ideally routed through the Chief Wildlife Warden, Wildlife Wing, Himachal Pradesh Forest Department).

[1] https://www.usgs.gov/software/bandit-software
[2] https://euring.org/data-and-codes/ringing-scheme-software
[3] https://www.usgs.gov/centers/pwrc/science/bird-banding-laboratory
[4] https://euring.org/data-and-codes/obtaining-data

(d) Recovery/Recapture Information: Bird ringing data makes sense only when seen together with recapture information. While many birds ringed at Pong are resident, data related to long-distance migrants breeding in other parts of the Indian Subcontinent and regions of Palearctic should also be collated regularly. To enable this, subsequent with the functioning of the ringing station, permanent and temporary ringing stations, organizations and individuals involved in bird ringing in range countries of Central Asian Flyway and African Eurasian Landbirds Action Plan should be identified and contacted to help keep a track of recaptures from both ends i.e. bird ringed at Pong visiting these regions and bird ringed at these countries visiting Pong. BNHS will get the recovery/recapture information currently and therefore it shall be ensured that constant

(e) Website: An official webpage for *HPFD Bird Ringing Program* should be developed subsequently. This website shall aim to highlight the activities of the centre, host brief reports of the ringing sessions, reporting of ringed birds, enable data sharing requests, enable ringing certification requests, serve as a point for correspondence, educate and create awareness about bird conservation.

6.5 Collaboration

As part of the *HPFD Bird Ringing Scheme*, it should be aimed to collaborate with both national and international academic and professional organizations (e.g. Salim Ali Centre for Ornithology and Natural History, Bombay Natural

History Society, Wildlife Institute of India, British Trust for Ornithology, EURING, North American Bird Banding Laboratory etc.) involved in long-term bird ringing and monitoring to enhance the scope of the ringing scheme, enable knowledge transfer and, promote and enhance the profile of bird ringing program in Himachal Pradesh.

7 Certification

Bird welfare is of primary concern and only people with required certification and proper training shall be allowed to conduct bird ringing at HPFD-run ringing stations within Himachal Pradesh (currently at the Avian Monitoring and Bird Ringing Station at Pong Dam Lake Wildlife Sanctuary). The certification guidelines presented below are applicable only to ringing activities at HPFD ringing stations.

The proposed model of long-term bird ringing by a state forest department is a first for the country; two points are of high importance: 1) ensuring very high standards of welfare during catching, processing and handling of birds, and, 2) establishing a fool-proof system of certification free of bias. The training to HPFD staff in bird ringing and handling was imparted by highly professional ringing experts from The Game and Wildlife Conservation Trust, U.K. with advanced bird ringing permits from the British Trust for Ornithology. This further reiterates the importance of continued collaboration with national and international organizations with extensive ringing experience which eventually led to the development of a long-term bird ringing program in Himachal Pradesh.

The certification shall involve an evaluation by ringing experts (advanced bird ringing trainees of HPFD) and subsequent issuance of ringing certification based on the recommendation of the experts. The certification will be issued by the Chief Wildlife Warden after evaluating necessary eligibilities.

7.1 Certification Levels

The certification required to carry out bird ringing is issued by HPFD following necessary evaluation of the applicants. Bird ringing training/capacity building opportunities shall be available at HPFD-run ringing stations within Himachal Pradesh. Two types of certification are proposed: Ringer Level-A and Ringer Level-B. The differences between the two relate to the experience and qualifications of the ringer and the responsibilities to be assumed.

1. Ringer Level-A will be issued to individuals to carry out bird ringing at HPFD ringing sites who possess a valid certification Ringer Level-B and who qualify the evaluation. Ringer Level-A individuals can independently extract, handle or ring birds and run ringing sessions. Preferably, this level of certification shall require a minimum experience of six months in bird ringing in the previous two years.

2. Ringer Level-B will be issued to individuals to carry out bird ringing at HPFD ringing sites to individuals who qualify the evaluation. Ringer Level B individuals can extract, handle or ring birds under the supervision of Ringer Level-A certification holders. Preferably, this level of certification shall require

a minimum experience of three months in bird ringing in the previous year.

3. Volunteering position is offered to individuals with or without previous bird handling or ringing experience. Preferably, individuals with some prior ringing experience may be considered.

7.2 Certification process and terms

1. To start with, the advanced trainees (who have attended three or more capacity building workshops) have been evaluated by bird ringing experts who conducted the capacity-building workshops in Himachal Pradesh. Based on their recommendation, they should be issued appropriate ringing certification as per the categories mentioned in the foregoing paras. The certification will be issued by the Chief Wildlife Warden of Himachal Pradesh.

2. Meanwhile, additional HPFD frontline staff shall be continued to be trained in bird ringing and handling under the supervision of HPFD certified ringers or as part of capacity building workshops.

3. In the case of Indian nationals applying for certification Ringer Level-A or Level-B with prior bird ringing experience, decision shall be based on their level of expertise and a demonstration of skills.

4. Foreign nationals are eligible for applying only to volunteering positions. Bird ringing experience is necessary for applying to volunteering positions, the proof of which will be checked prior to approving voluntary positions. Foreign individuals are responsible for obtaining necessary permits and clearances for

participating in ringing at HPFD-run bird ringing sites. The minimum age to apply for volunteering position at HPFD ringing stations is 18 years for foreign nationals. Volunteers will be issued a participation certification specifying the duration of bird ringing.

5. Vounteering applications can be submitted either in person or electronically through email to the ringing stations in Himachal Pradesh or concerned Wildlife Warden (currently to the one situated at Pong). The concerned Wildlife Wardens (in the case of Pong, DFO Wildlife Hamirpur) shall scrutinize and recommend voluntary participation in ringing at HPFD bird ringing stations based on the recommendation by Ringer In-charge to the Chief Wildlife Warden (Himachal Pradesh) for necessary processing and approval.

6. Bird Ringing Certification is non-transferable.

7. Ringer Level-A and Level-B certification shall be valid for three years (except the Ringer In-charge who will be involved in regular ringing at HPFD bird ringing stations). At end of three years, the certificate holders shall contact HPFD Ringing station personnel seeking renewal. The details of ringing carried out by the individual during the time of active certification shall be provided at the time of applying for renewal.

8. Minimum age to apply for a Ringer Level-A and Level-B certification is 18 years.

9. Minimum age to apply for volunteering position at HPFD ringing station is not fixed but preferably should be given to individuals 18 years or older.

10. The process of certification shall be adaptive, and upon implementation of these policy guidelines it shall eventually aim to follow the framework adopted by long-term ringing programs in Europe and North America.

7.3 Suspension or revocation of certification

Bird ringing certification will be suspended or revoked:

1. if the person is found convicted of any wildlife crime;
2. if the person is found collecting biological samples without necessary permission;
3. if found misusing mist-nets or other ringing equipments;
4. if the ringer's qualifications or conduct are questioned, investigated, and subsequently found to be in breach of the guidelines mentioned in this policy document or other wildlife and environmental legislations.

8 Technical aspects of Bird ringing

The aim of the bird ringing station is to achieve long-term surveillance of spring and autumn bird migration, changes in over-wintering behaviour and in seasonal migration patterns, habitat selection of breeding birds and other studies of special objectives (as decided by the technical group). Ringing requires catching birds, with mist netting being the most widely used technique. The guidelines presented below are applicable to ringing activities at the HPFD designated ringing stations as part of

the *HPFD Bird Ringing Program*. These ringing stations are identified, established and permitted to function in accordance to the legal framework provided in the Wildlife Protection Act (1972) and other relevant laws. If mist-netting locations of a particular ringing station are situated in privately-owned land, permission of the owner should be obtained by relevant personnel of the *HPFD Bird Ringing Program*.

Only broad principles concerning the technical aspects involved in bird ringing are provided here. Detailed guidelines described in: Bird Ringing - A concise guide: British Trust for Ornithology [15], Bird Ringing Station Manual: Przemysław Busse, Włodzimierz Meissner [14], Guidelines to the use of wild birds in research (published by The Ornithological Council), North American Bander's Study Guide (published by the North American Banding Council) and Indian Bird Banding Manual (published by the Bombay Natural History Society) should be adhered to. Many illustrations and protocols used in this document are borrowed from [14] licensed under the Creative Commons Attribution-NonCommercial-NoDerivs 3.0 license, which means that the text may be used for non-commercial purposes, provided credit is given to the author.

8.1 Mist-Netting: Rules and Codes of practice

The process of mist-netting and catching birds for ringing requires considerable skill and knowledge for it to be safe especially for the welfare of the bird and ringer. The guidelines for operating mist-nets are as follows:

8.1.1 General

a. Mist-netting is only permitted for the purpose of ringing and for the benefit of science and conservation.

b. Mist-netting in very low (lower than 5° C), very hot weather (above 35° C) and during rains is not permitted.

c. Mist-netting during the breeding season should be avoided, unless it entails a specific management objective or as suggested by the Technical Group and should only be carried out by Level-A Certificate holder issued with permission to carry out such ringing exercise.

d. Ringing pulli (birds ringed in the nest) is not permitted, unless it entails a specific management objective or as suggested by the Technical Group and should only be carried out by Level-A Certificate holder.

8.1.2 Mist-net

To catch birds with nets, only mist-nets specifically designed to catch birds should be used. For purposes of these guidelines, mist-nets shall be kept only at designated ringing stations as part of the *HPFD Bird Ringing Program*. It is illegal to use a mist-net in Himachal Pradesh without necessary permissions. Mist-nets must be procured directly by HPFD Ringing Station (through Hamirpur Wildlife Division in the case of Pong Ringing Station) through the organizations running national/international ringing schemes or any other reputed national/international manufacturer (e.g. BNHS, BTO, Ecotone etc.). Each ringing station must have an

inventory of the mist-nests. Mist-nets must not be lent, sold or supplied to ringers or others and should remain in the inventory of the respective ringing station. Mist nets must be well maintained and in good condition at all times. Nets must be kept in a safe place at all times when not in use and out of reach of unauthorised individuals. Nets must be kept in good order at all times and must not be used if broken. As they are prone to UV damage, damaged nets should be mended prior to use. Nets should be repaired for small damages regularly. Nets with unrepairable damage must be burned.

Non-target species (such as bats for example) caught must be extracted and released following the same guidelines applicable to birds; but while taking necessary precautions using masks and thick leather gloves on both hands to avoid transmission of rabies and other viral diseases. Mist-nets should not be set-up during the night if high numbers of bats are expected. Mist-nets must be furled (rolled up) securely when left unattended (no net-rounds for more than one hour) or in case of inclement weather, and checked regularly (preferably once in every six-eight hours). Mist-netting locations should preferably be selected where chances of theft or interference is minimal. Only mist nets from certified mist net producers must be used.

If nets are stolen, a thorough inquiry to trace them and steps to prevent such events should be undertaken including investigating the local area for illegal use of stolen nets. If required, help of local police may also be sought to ensure that the nets are not misused.

8.1.3 Mist-net Safety

Extensive experience with mist-nets across the world has shown that they are a safe and effective means of catching birds when used by well-trained ringers. Each ringer has to adhere to important protocols governing the use of mist-nets mentioned below:

a. An active ringing station (one where nets are open and birds are being captured and ringed) must be supervised constantly by the ringing station in-charge (A Level-A certificate holder).

b. The ringing station in-charge is responsible for the overall supervision of the ringing station. The in-charge is also responsible for overseeing planning, assigning net-rounds, ringing and record-keeping duties and its monitoring.

c. Protocol/policy or disciplinary violations by anyone at the station OR complaints against anyone at the station will be examined by a committee. If guilty, the person will be issued a warning in the first instance and will face disciplinary action (up to cancellation of the certificate) in the second instance.

d. Nets must be visited at regular intervals (referred to as net-round). Under ideal weather conditions, the interval between net-rounds should not be more than 30 minutes.

e. The number of mist-nets set must match the number of ringers present to guarantee that all nets can be checked at least every 30 minutes, and also if a large number of birds are caught unexpectedly.

f. If the number of birds caught prevents the ringing team to check all nets every 30 minutes, an appropriate number of nets must be furled (rolled-up).

g. If the weather conditions deteriorate during a ringing session (start of drizzle, increase of rain or wind, temperature drop or increase), appropriate action must be taken to guarantee continued welfare of the birds. Typically, this involves either frequent net-rounds or furling of all the nets.

h. Nets left open over-night must be visited at 30 minutes intervals.

i. Nets must be maintained during the rounds of net control. This includes checking the tension and keeping the nets free from leaves, twigs, bigger insects etc. (especially dung beetles, which can do serious damage to nets).

j. A thorough check of the nets before the last check is recommended to prevent birds from being overlooked in hidden positions; a passerine will die if left in the nets overnight.

8.1.4 Extraction of birds from Mist-nets

Extracting birds from mist-nets requires a lot of practise, skill and patience. Every bird caught in a mist-net presents a unique problem of extraction. The technique has to be learnt through practise under the supervision of the ringer in-charge or Level-A certificate holder. It is the responsibility of the ringer in-charge to oversee smooth and safe bird extraction. In case a ringer is unable to extract a bird within 5 minutes, the ringer in-charge or Level-A certificate holder shall intervene to extract it safely. A wireless system should be made available at the ringing station, which

should be carried by ringers on net rounds to update ringer-in-charge in case of an exigency. If the person in question continues to struggle with extracting birds, the ringer in-charge is expected to make an appropriate decision to solve the issue. In some instances, circumstances may warrant that the person must be prevented from extracting birds and assigned a different duty, such as entering data at the ringing table.

The broad steps for removing a bird caught in the mist-net are [14]:

1. Determine from which direction the bird has entered the net.
2. Take the bird by the legs (at the knee joint) and lift it gently out of the pocket.
3. Free the legs of the bird first.
4. Holding the bird still by the knee joint, peel the net away from the wings (one after the other), and finally the head.
5. A problem often met occurs when a thread gets hooked up on a tongue spur (especially frequent when thrushes are caught). Use a Quick-un-pic for freeing the thread if required (see Figure 10).
6. After extraction, place the bird into a bag, close the bag by pulling its string, slip down the lock and hang it up on the neck hanger.
7. see Figure 13 for a pictographic process of removal process.

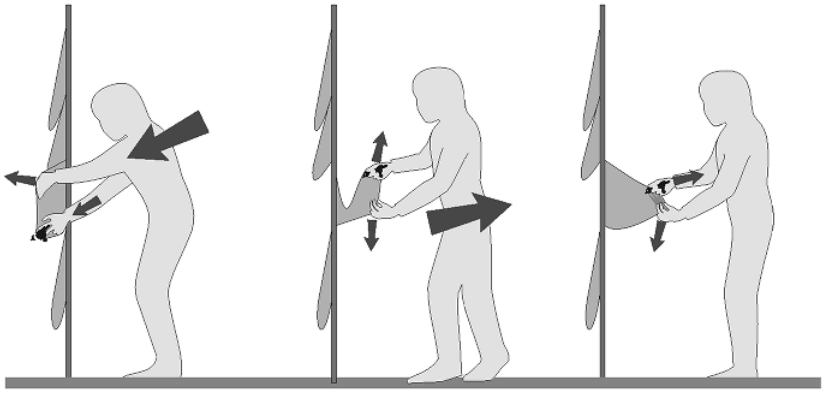


Figure 13: Process for extracting a bird caught in a mist-net.

8.1.5 Any other catching techniques

Alternative methods of bird capture such as Cannon nets, Heligoland traps, Walk-in traps etc. may be proposed to be used for addressing specific objectives as proposed by the Bird Ringing Technical Group. It is likely that these alternative catching techniques are well-used and rigorously tested elsewhere in the world, the results of such studies must be reviewed by the Technical Group to justify the use of these methods. If necessary, a demonstration of the technique may be offered prior to granting approval to ensure that the ringers correctly understand the technique and its safe use. A widely-used *novel* technique must however be first tested on a small scale, before larger-scale use. In addition to protocols followed for mist-netting, internationally specified standards should be referred during the implementation of other catching techniques.

8.2 Handling, keeping and releasing trapped birds

A ringer must be adept at handling birds, which requires considerable time to develop. In particular, ringing station in-charge and Level-A certificate holders must have adequate experience and advanced skills to handle all the bird species likely to be captured at the ringing station. It is important to recognise that a bird could suffer death or injury as a result of careless handling. Also, the handler could suffer serious injury when handling birds with sharp bills, claws or powerful wings. Some birds, when caught, may hurt your fingers or even your eyes. Some birds can inflict injury during handling (e.g. bitterns and herons have long necks with appear retracted but can extend greatly, talons of owls and other raptors, shrike and parakeets have strong beaks capable of inflicting serious injury to the handler). To ensure maximum welfare of birds handling time during ringing should be minimized as much as possible. The basic principle of good handling is to minimise stress and avoid injury or death. A meta-analysis of passerine & near-passerine ringing data by [21] and [22] from ringing carried out in the United States, Canada and Great Britain revealed an average injury rate of 0.59% and mortality of 0.23% or lower. Hence, when ringing is conducted with bird safety precautions in mind and adequate training, injury and mortality rates can be less than 1%.

8.2.1 Good practise in bird handling and keeping

a. Birds must be handled and held using the appropriate handling grip which may vary between species and situations (see Figure 14 for standard method for holding a bird).

b. Birds must be held in a way to minimize injury.

c. Birds extracted from mist-net must immediately be transferred into a bird bag or container of appropriate size and design. Therefore, an appropriate number of suitable bird bags in different sizes or containers need to be organised prior to any ringing event (see Figure 9).

d. Each bag may have only one bird at the time. Containers may hold more than one bird, with the number depending on container size and the bird species.

e. Bird bags or containers need to be washed regularly once every two weeks.

f. Birds held in bird bags or containers which await processing, need to be kept in a shaded and quiet place. As a general rule, birds should be released un-ringed if they have been waiting to be ringed for longer than an hour. For larger birds, in particular non-passerines, this can however be extended for 1.5 hours.

g. If a diurnal bird could not be processed and released during daylight, it may be kept in a bag overnight and released the next early morning.

h. Area where bird bags are placed must be ensured free of wild (e.g. crows, jackals, foxes etc.) and feral (e.g. dogs, cats etc.) predators.

i. Some special health problems can occur during ringing work with birds since they can be vectors of different, even potentially dangerous, diseases: avian flu and other virus, bacteria, or fungi originated illnesses. Although uncommon, these problems can be averted by simple hygiene routines – washing hands, not using dirty bird bags for wiping noses or cleaning a kitchen table, eating at the ringing

table and regular disinfection (only 70% alcohol for disinfection is allowed). It is further recommended that a basic first aid kit with additional supplies for wound service, pain, allergy, cold, and stomach problems are available at the ringing site.

j. No food should be bought in the ringing room and no food should be prepared within the premises of Avian Monitoring and Bird Ringing Station at Nagrota Surian, Pong Dam Lake Wildlife Sanctuary.

k. Ringers have the responsibility to maintain the high standards of the HPFD Bird Ringing Scheme. If a ringer notices poor handling techniques of a fellow ringer, it should be brought to the notice of the ringing station in-charge to remedy the problem

l. For standard handling practices for examination, demonstration and photograph purposes refer to Figure 15.

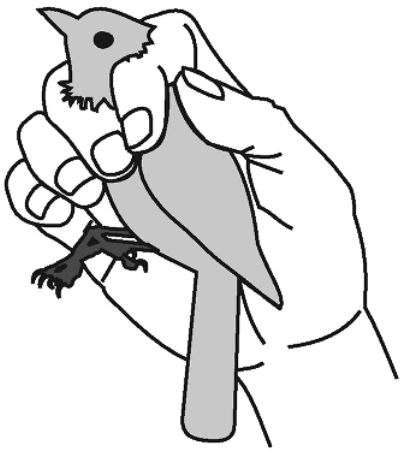


Figure 14: Standard holding position of a bird during ringing and examination.

(a) Correct handling of a bird for photographs.

(b) Correct handling of birds for tail examination and photographs.

(c) Correct handling of birds for feather comparison and photographs.

(d) Correct handling of waders for photographs.

Figure 15: Standard methods for handling birds for examination, demonstration and photographic purposes.

8.2.2 Data collection

a. Species determination and coding: Species determination is undoubtedly a fundamental starting-point for ringing. For ringing purposes, a good key or the *bird in the hand* type of manual should be used (see page 40). For recording species names in the ringing form, five-letter codes based on common names should be used. For example: Bluethroat – BLUET; Bank Myna – BANMY; Black-chinned Babbler – BLCBA; Grey-headed Canary Flycatcher – GHCFL.

b. Sex determination and ageing: Protocols described in [15] should be followed. Refer to appendices C – F for an overview of bird topography, EURING age codes, EURING fat and muscle scores as described in [15].

c. Standard descriptions of measurements from [15] and [14] is recommended to be followed while recording biometric data of birds. For example: see Figure 16 for pointers on wing measurements from [14].

d. A recommended format for recording ringing data is provided in Appendix – G.

e. Photo documentation of processed birds: All

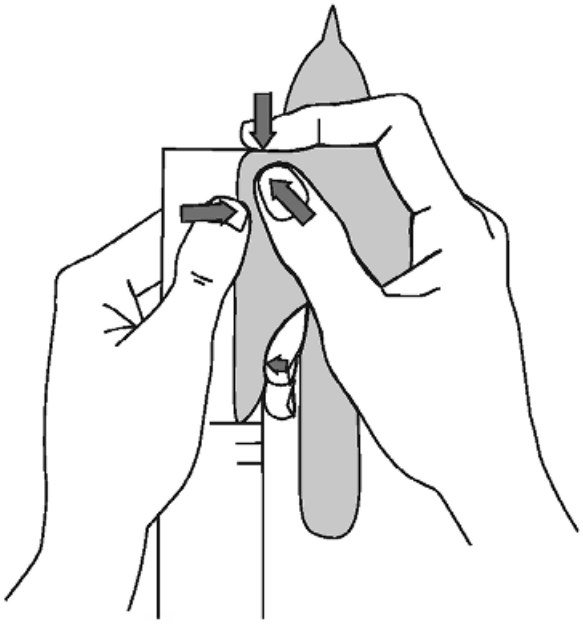


Figure 16: Standard measurement of the wing-length (critical elements of the procedure pointed by arrows).

8.2.3 Good practise releasing birds

a. Birds should always be released into suitable habitat at the ringing site close to the point of capture.

b. These standard practices may be followed for releasing birds after processing:

   - Shorebirds should be taken to near the water's edge and released by lowering them to the ground level. Loosening the grip should allow the bird to walk away by itself.
   - Large birds with long wings and short legs (e.g. raptors) may gently but firmly thrown upwards and away from self.
   - Passerines should never be thrown into the air or released high above the ground. While holding the bird in the handler's grip, opening the hand palm downwards onto the other hand, should allow the bird to fly away. A gentle nudge, in case of birds unable to fly properly, may aid departure.

c. Released birds must never be chased and should always be allowed time to walk and fly off.

d. Birds should not be released into the direction of mist-nets to avoid immediate recapture.

e. If adults are caught in a pair, with juveniles, as family group or in flock, they should be released together. Dependent juveniles should be returned to the location of capture to allow a quick reunion with the rest of the brood.

f. Birds that are trapped after sunset or during the night must be kept in appropriate bird bags or containers until they are processed and released next morning (see [15] and [14]). Exceptions to this include nocturnal birds such as owls, nightjars and waders or passerines migrating during the night.

g. The last round, including furling of nets, should commence no later than half an hour before sunset during daytime ringing sessions.

h. Birds that are released during the night must be released away from light so that their eyes can re-adjust to the dark before flying away.

8.2.4 Protocol for demonstration of bird ringing

Creating awareness, sensitizing officials and general public should be an integral part of the functioning of Avian Monitoring and Bird Ringing Station at Nagrota Surian and HPFD bird ringing in general. However, as bird ringing entails handling of birds which not all may be familiar with and involve extended bird handling, the following measures should be taken while demonstrating bird ringing process as part of community awareness or official demonstrations.

- The target group should be instructed to wear neutral coloured clothes, not carry any baggage into the ringing room and avoid people with communicable diseases from entering the ringing room. No eatables should be bought into the ringing room.

- The bird handling method should first be explained to the group to provide an overview of standard and safe bird handling procedures.

- For each demonstration session, the target group size should not comprise of more than 10 people entering the ringing room. For larger groups, arrangement for viewing from outside of the ringing room should be made.
- Only hardy species such as Babblers, Common Myna, Thrushes, Galliformes, Barbets etc. should be used for bird ringing demonstration. Species which weigh less than 15g (such as Warblers, Bushchats, Tits, Prinias etc.), raptors and predatory birds should be avoided for demonstration.
- Demonstration of extraction of birds from mist nets should not be done. For purposes of demonstration, captured birds should not be kept in bags waiting for more than 20 minutes.
- During demonstration, handling/petting of birds by the target group, application of rings and releasing of birds should not be allowed.
- Photography of bird ringing process by target group should not be allowed. A set of pre-selected photographs may be identified for sharing purposes.
- Noise and close flanking of the ringer by the group should be avoided.
- Extended handling or storing birds in bird bags for extended periods of time the sake of demonstration should not be allowed.

8.3 Rings

Metal rings used for ringing wild birds have proved to be a safe and the most cost-effective way to mark birds throughout the world for the purpose of science and

conservation. At around 0.01% of a bird's body weight, the weight of a ring is insignificant in relation to the daily fluctuations in body weight of 10% or more which occur in many species. Once fitted, good-quality bird rings wear away slowly, the rate of wear depending on the quality of ring and the behaviour of the bird that carries the ring. The longest-lived known ringed wild bird is a Laysan Albatross *Phoebastria immutabilis*, aged 63 years. The rings are inscribed with a unique number and return address of the ringing organization. Rings procured by BNHS have the numbering inscribed in this format: Z31305 Inform Bombay Nat.Hist. Society (The letter(s) representing ring type based on the diameter followed by a unique number of a series and a short name of the organization; see Figure 17). Important: As the rings currently used are procured from BNHS, a formal communication should be established with the organization to inform HPFD about the recovery information of the birds (as its organization address is inscribed on the rings) received by them which are ringed as part of *HPFD Bird Ringing Scheme*. With expansion of the ringing program, rings can also be procured from other national or international manufactures independently with HPFD address, provided the quality is of the required standard. The inscription should follow the format on BNHS rings (as described before), for maintaining uniformity. A preliminary list of species-specific ring sizes and species codes are provided at Appendix I (page 85).

Colour ringing: Tagging of birds using colour markers – colour rings is very close to the classic ringing. Generally, colour rings are similar to normal metal rings, but made of colour plastic, but differentiated by colour, not by inscriptions and numbering (although some of them are bearing numbers). Colour ringing allows

Figure 17: Inscription on the currently used rings procured from BNHS.

identification from a distance by colour or combination of colour rings or a combination of metal and colour rings; it is not necessary to re-trap the bird to have return information on the bird. This makes collecting ecological information about birds at breeding area much more efficient than waiting for subsequent catches. Use of colour ringing (including leg bands, neck collars, or if found appropriate wing tags) as part of HPFD Bird Ringing program is permitted as intended to answer specific ecological questions or as recommended by the Technical Group.

8.3.1 General principles of ringing

a. Birds caught for the purpose of HPFD Bird Ringing Scheme should all be ringed. Exceptions include: birds caught for capacity building purposes only, injured or sick birds, or birds for which no suitable ring is available at the time of capture.

b. *First In, First Out* principle should be employed during bird ringing i.e. birds should be processed in the order in which they were caught or brought to the ringing table with exceptions being:

   - a breeding female,

- a parent possibly feeding young,
- an immature still dependent on its parents,
- one of a family group or breeding pair which may move off,
- a bird that shows any signs of stress (e.g. an inidividual that was difficult to remove from the mistnet).

8.3.2 Ring sizes

a. Rings of appropriate sizes, based on tarsus measurement, should be used to ring birds. Specialist ringing equipment is necessary for this such as ringing pliers and circlip pliers to remove any overlapped or broken ring. In addition to this, other equipments including wing rulers and weighing equipment suitable for birds of different sizes should be available at the ringing station. See Figure 10 for laboratory tools.

b. An updated ring-size list prepared as part of HPFD Bird Ringing Scheme should be available at all HPFD ringing stations. Each HPFD ringing station must have enough rings of various sizes likely to be used.

c. In case of species for which ring sizes are not known, or birds with abnormally thick or thin legs, an appropriate ring size is decided based on tarsus measurement.

d. In exceptional circumstances rings may be overlapped, using the next bigger ring size with extreme care. If no such ring is available, the bird must be released un-ringed.

e. Only one metal ring should be fitted per bird, in addition to color rings based on pre-defined coding system.

9 General Issues

9.1 Research and training

Training beginners: Measurements are of value to science when they are reproducible, i.e. do not depend on the individual characteristics of the person. The compatibility of measurements does not imply that two people present identical results for each bird measured independently by them, but rather, it implies statistical concordance for a series of measurements done by a number of people measuring the same sample of birds. This situation is attainable when the standard techniques are carried out strictly according to the rules described above. The system of instruction must guarantee correct interpretation of these standard descriptions of techniques, ensure correct execution of measurements and cross check the results of this instruction.

Research as part of HPFD Bird Ringing Scheme: During the implementation of the long-term bird ringing in Himachal Pradesh, efforts to initiate research projects should be undertaken – such as employing geolocators to study migration or projects employing color ringing to study demography. Such projects may necessitate collaboration with research and academic organizations which will further improve the scientific credibility of HPFD-run bird ringing program in Himachal Pradesh. A project to study migratory routes of Bluethroat (a wintering passerine at Pong) was started in March 2017 – see Figure 18.

Figure 18: A Bluethroat fitted with a geolocator during 2017 ringing workshop at Nagrota Surian. Small research projects like this can reveal novel and interesting information on migration ecology which in turn can be used to improve effective conservation management.

9.2 Animal welfare

At all times, HPFD-run ringing station should maintain high welfare standards as outlines in ringing manuals mentioned before including [23]. Professional ringing standards are known to result in less than 0.5% mortality rates. General points on avoiding or reducing mortality rates during bird ringing are listed below:

- Use of mist-net with thicker mesh thread (e.g. Ecotone nets) for standard catching.

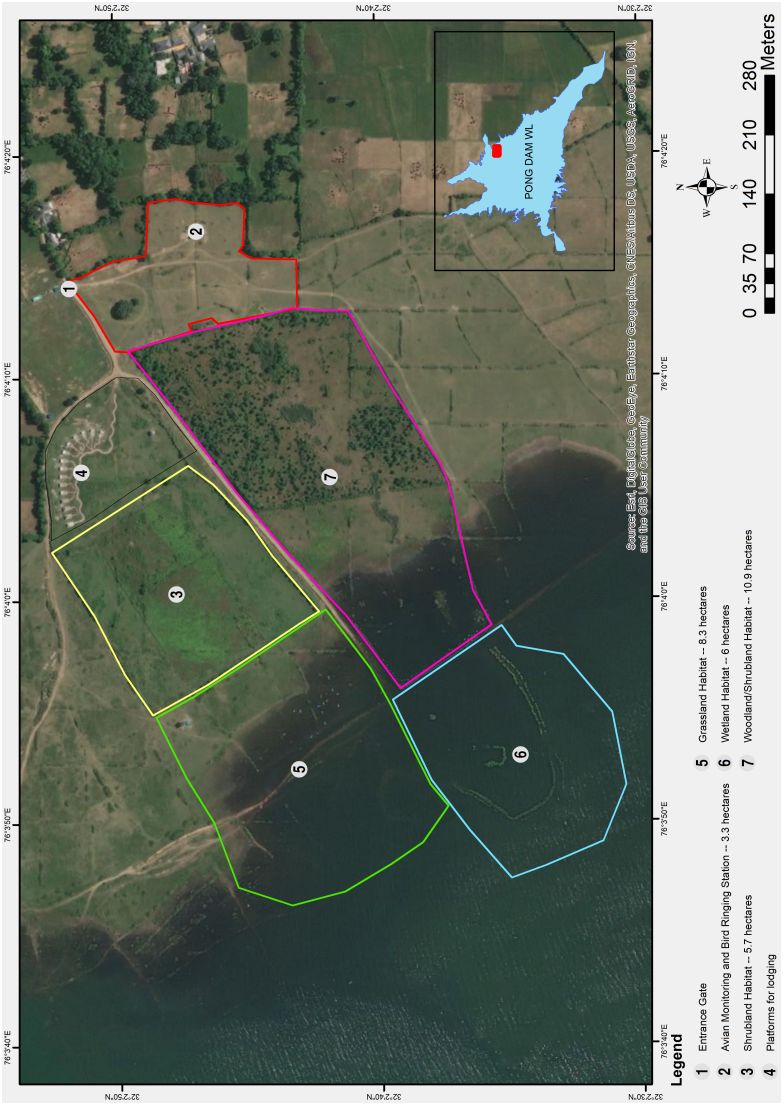
- Predators such as avian raptors, mustelids and sometimes domestic dogs and

cats attack birds caught in mist net. If mist-netting is being done in an area prone to such attacks; extra monitoring, use remote wireless cameras and use of solar fencing may be employed to reduce such incidents.

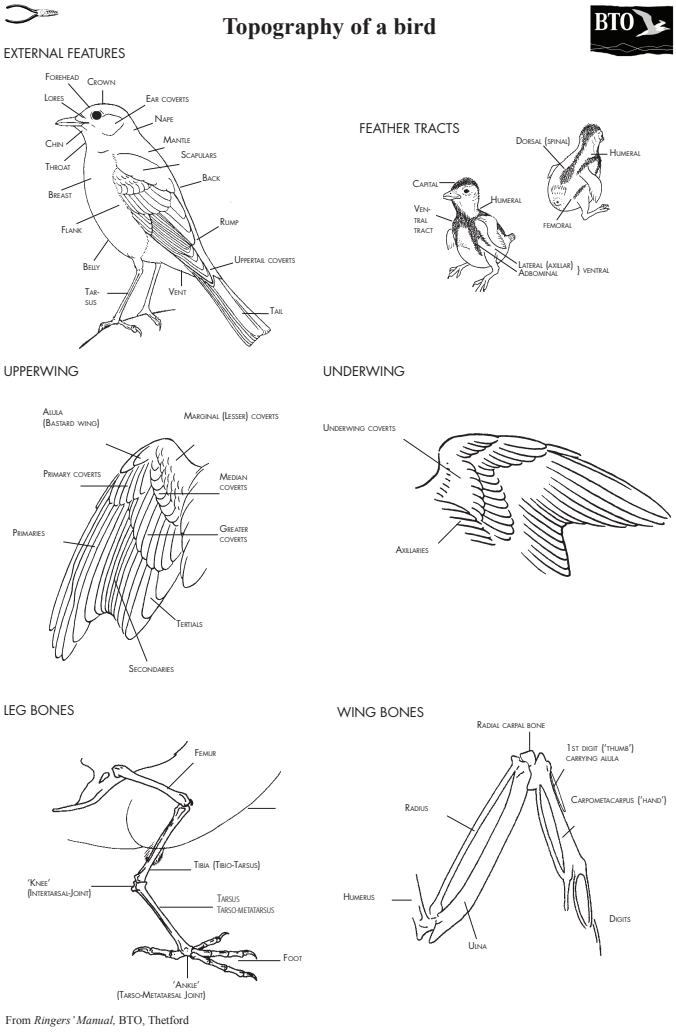
- Problematic predators at ringing sites may be allowed to be caught and transolcated to a suitable site at an appropriate distance to the ringing site.
- When a large number of birds are caught in nets, care must be taken to ensure no birds are left behind after an exhaustive extraction.
- During inclement weather, extra care should be taken to ensure that trapped birds are not left in the nets wet & cold for long.
- Careful transportation of extracted birds in a bird bag and quick processing should be ensured.
- In spite of the aforementioned measures, there exists a likelihood that birds get injured or die during ringing (to reiterate, professional ringing standards result in less 0.5% bird mortality), and the steps outlined in [14] page 175, section 14.5 shall be followed for deciding the appropriate course. In case a bird is injured beyond recovery during extraction/handling it should be euthanized in accordance to the international code of practice.

Appendices

A Avian Monitoring and Bird Ringing Station Site



B Bird Morphology



From *Ringers' Manual*, BTO, Thetford

C EURING Age Codes

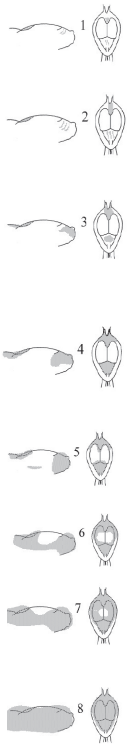
EURING age codes

EURING Number	Definition
0	Age unknown - only to be used if data have been lost and the ringer has no idea if a bird was a nestling or full-grown
1	Pullus (Use P not 1 for pullus on handwritten schedules as a series of 1s looks like a ditto line)
1J	Passerines only - fledged, but flying so weakly that it is obviously incapable of having flown far from the nest (include as pullus for annual totals)
2	Fully grown, year of hatching quite unknown (including current year)
2J	Fully grown, year of hatching quite unknown (including current year), still partly or completely in juvenile body plumage (rarely used)
3	Definitely hatched during current calendar year (eg first-years in autumn)
3J*	Passerines only - definitely hatched this calendar year and still partly or completely in juvenile body plumage*
4	Hatched before current calendar year - exact year unknown (eg many adults in autumn)
4I	Hatched before current calendar year - exact year unknown but definitely not full adult
5	Definitely hatched during previous calendar year (eg first-years in early spring)
5J	Definitely hatched during previous calendar year (eg first-years in early spring) still partly or completely in juvenile body plumage rarely used)
6	Hatched before last calendar year - exact year unknown (eg many adults in Spring)
6I	Hatched before last calendar year - exact year unknown but definitely not full adult
7	Definitely hatched in calendar year before last
8	Hatched three or more years ago - exact year unknown
8I	Hatched three or more years ago - exact year unknown but definitely not full adult
9	Definitely hatched three years ago
10	Hatched four or more years ago - exact year unknown
11	Definitely hatched four years ago
12	Hatched five or more years ago - exact year unknown
13	Definitely hatched five years ago
14	Hatched six or more years ago - exact year unknown
15	Definitely hatched six years ago
16	Hatched seven or more years ago - exact year unknown

*Because juvenile plumage - ie the feathers grown by the birds in the nest - is more easily recognised than the plumage which succeeds it, the analyst can assume a high degree of accuracy in birds aged 3J, whereas those aged 3 might possibly include a few individuals which were in fact older.

D Fat Scores

Fat Scores



(a) ESF system		(b) BWG System
Score Description		Score Description
0 no visible fat. Dark red		0 no visible fat. Dark red
1 F: wide wedge of fat. A: trace of fat. Light red		1 F: trace of fat. (~E0.5) Light red/pink
2 F: completely covered but deeply concave. A: slips of fat. Light yellow		2 F: base of tracheal pit obscured by fat to about one third full. (~E1.0) Yellow-pink
3 F: moderate fat reserves cover ends of inter-clavicles but concave. A: flat or slightly bulging pad. Light yellow		3 F: tracheal pit about two-thirds full. Muscle within tracheal pit visible between fat and clavicles. (E~1.5) Yellow-pink
4 F: filled up to far end of clavicles. A: covered by clearly bulging pad of fat. Yellow		4 F: completely filled up to far end of clavicles but still concave (not bulging). (~E3.0) Pale yellow
5 F: convex bulge, perhaps overlapping breast muscles. A: extreme convex bulge. Yellow		5 *As ESF*
6 F and A: fat covering breast muscles by several mm.		6 *As ESF*
7 F and A: $^3/_4$ of breast muscles covered. Yellow		7 *As ESF*
8 F and A: breast muscles not visible. Yellow		8 *As ESF*

(F=Furcular region or tracheal pit; A=Abdomen)

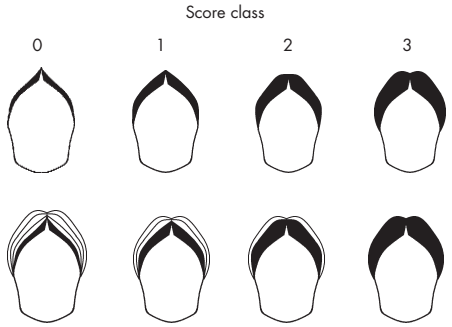
Under the BWG scale, ESF scale equivalents are given (eg E0.5) eg a score of 3 on the BWG scale is equivalent to about 1.5 on the ESF scale.

From *Ringers' Manual* BTO, Thetford

E Pectoral Muscle Scores

Pectoral muscle score

Score Class	*Prominence of sternum*	*Pectoral muscle shape*
0	Sternum sharp	Muscle depressed
1	Sternum easy to distinguish but not sharp	Muscle neither depressed, sharp nor rounded
2	Sternum still distinguishable	Muscle slightly rounded
3	Sternum difficult to distinguish	Muscle rounded (full)



The black areas are the muscles.
The white areas on the bottom row show the differences between scores.

Pectoral muscle scores
After Bairlien (1995) redrawn, with permission from *European-African Songbird Migration Network Manual of Field Methods.*

From *Ringers' Manual*, BTO, Thetford

F Ringing Data recording format

Location - Date - Page number -

Ring Number	Species	Net	Age	Sex	Moult	Wing	Weight	Fat/Mus.	Time	Rngr.	Notes - OGC, Moult scores, Special Data

G Details of ringing workshops, ringing trainers and trainees

Details of capacity building workshops in bird identification, handling and ringing held at various locations in Himachal Pradesh.

Workshop location	**Dates held**
Sai Ropa, Great Himalayan National Park	21.10 — 2.11.2013
Sai Ropa, Great Himalayan National Park	08.03 — 16.03.2014
Nagrota Surian, Pong Dam Lake Wildlife Sanctuary	18.01 — 31.01.2015
Nagrota Surian, Pong Dam Lake Wildlife Sanctuary	14.02 — 27.02.2016
Nagrota Surian, Pong Dam Lake Wildlife Sanctuary	04.03 — 19.03.2017
Sarahan Pheasantry	14.03 — 18.03.2018

Details of international collaborators and ringing experts

Name	Ringing License details
Dr. Francis Buner	BTO Permit-C Ringer
Tim Walker	BTO Permit-A Ringer
Mark Mallalieu	BTO Permit-A Ringer
Eric Wood	BTO Permit-A Ringer
Christopher Brown	BTO Permit-A Ringer
Dr. Dan Hoare	BTO Permit-C Ringer

Staff of HPFD trained in bird handling and ringing during capacity building workshops

No.	**Name**	**Ringing Workshop Attended**					
		2013	**2014**	**2015**	**2016**	**2017**	**2018**
1	Bhupinder Rana	✓	✓				
2	Sat Pal Dhiman	✓	✓	✓	✓	✓	✓
3	Devinder Singh Dhadwal	✓	✓	✓	✓	✓	
4	Lakshminarasimha R			✓	✓	✓	✓
5	Suneet Bhardwaj	✓					
6	G.S. Chandel	✓					
7	Ashok Chauhan	✓					
8	Dinesh Paul	✓					
9	Sachin Sharma	✓					
10	Devender Chauhan	✓					

11	Sanjeev Kumar	✓	✓	✓	✓		
12	Vinay Kumar	✓	✓		✓	✓	
13	Sunil Kumar	✓	✓	✓			
14	Kavinder Kumar	✓	✓		✓	✓	
15	Sarita Kundal	✓	✓	✓	✓	✓	
16	Surjeet Pathania	✓	✓	✓	✓	✓	
17	Reetu Patial	✓	✓	✓	✓	✓	
18	Virender Sharma	✓	✓	✓	✓	✓	
19	Kamlesh Sharma	✓	✓	✓	✓	✓	
20	Santosh Thakur	✓	✓	✓	✓	✓	✓
21	Meena Kapoor			✓	✓	✓	
22	Neha Thakur			✓	✓	✓	
23	Sarita Devi			✓	✓	✓	
24	Usha Devi	✓	✓				
25	Nishant Kumar	✓	✓				
26	Rakesh Kumar	✓					
27	Vijay Kumar	✓					
28	Kamaljeet	✓		✓			
29	Roshan Lal	✓					
30	Seena Shandil	✓		✓			
31	Harish Chander	✓					
32	Suresh Kumar	✓		✓			
33	Vishal Jamwal	✓		✓			
34	Devender Singh	✓					
35	Harish Hudden			✓			✓
36	Vinkesh Chauhan						✓
37	Arun Bhardwaj						✓
38	Manju Bala						✓
39	Gulshan Kumar						✓
40	Jitender Thakur						✓
41	Shiv Kumar				✓	✓	
42	Ajay Chaudhary					✓	
43	Sanjeev Rana					✓	
44	Sachin Sirmouri					✓	

H Recommendation letter of trainees

Recommendation for an HP ringing 'A' permit

Fordingbridge, 14.2.2020

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To whom it may concern

We, the undersigned, herein confirm that the following persons be granted an 'A' permit status for the successful manning and running of the Pong Avian Monitoring and Ringing Station at Nagrota Surian: ***Sat Pal Dhiman, Lakshinarashima Ranganathan, Devinder Singh Dhadwal, Reetu Patial, Surjeet Pathania, Virender Sharma and Santosh Thakur***. All mentioned candidates have reached the necessary basic requirements for the safe and correct processing of birds caught using mist nets, in accordance with the 'Policy Guidelines for Bird Ringing in Himachal Pradesh', the purpose of which is to ring birds, both resident and migratory, using specific bird rings that are currently issued by the Bombay Natural History Society. This technique allows unique insights into population dynamics, breeding success, local movements and migratory routes for a wide range of bird species to complement conventional field studies (see also specific Ringing Guidelines).

All the above-mentioned candidates have participated in at least four of a total of six training sessions held at Sairopa (twice), Nagrota Surian (three times) and Sarahan (once) since October 2013. We recommend that at least three of the listed individuals, after receiving their HP A-permit, will need to be present for facilitating a ringing session, until a full-time 'Ringer-in-charge' has been appointed to run the Avian Monitoring and Bird Ringing Station at Pong (after which the rules outlined in the official HP ringing Guidelines will need to be followed).

All the candidates listed above have obtained the necessary experience in setting mist nets, extracting caught birds, correct species identification, adequate ageing and sexing of caught individuals where applicable and possible at this stage of their training, and taking basic biometric data. They are also all able to enter and process the collected data as to the expected standard.

Yours sincerely,

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I Species-specific ring sizes and codes

List of species, species-specific five-letter codes and ring sizes. The ring sizes allocated to each species in this list are based on measurements taken from captured individuals and the rings available during the training workshops. The inner diameters of each ring size used in ascending order are Y=1.8mm, Z=2.3mm, A=2.5mm, AA=3.0, AB=3.45mm, B=4.0mm, BC=4.6mm, C=6.45mm, F=8.0mm.

Species	*Scientific Name*	Species Code	Ring Size
Ashy Prinia	*Prinia socialis*	ASHPR	Y
Ashy-throated Warbler	*Phylloscopus maculipennis*	ASTWA	Y
Asian Barred Owlet	*Glaucidium cuculoides*	ASBOW	F
Bank Myna	*Acridotheres ginginianus*	BANMY	B
Barn Swallow	*Hirundo rustica*	BARSW	Z
Bar-tailed Treecreeper	*Certhia himalayana*	BATTR	Z
Bar-throated Siva	*Siva strigula*	BATSI	A
Baya Weaver	*Ploceus philippinus*	BAYWE	A
Black Bulbul	*Hypsipetes leucocephalus*	BLABU	AB
Black Redstart	*Phoenicurus ochruros*	BLARE	Z
Black-chinned Babbler	*Stachyris pyrrhops*	BLCBA	Z
Black-throated Accentor	*Prunella atrogularis*	BLTAC	Z
Black-throated Tit	*Aegithalos concinnus*	BLTTI	Z
Blue Whistling Thrush	*Myophonus caeruleus*	BLWTH	B♀, BC/C♂
Blue-capped Redstart	*Phoenicurus caeruleocephala*	BLCRE	Z
Blue-fronted Redstart	*Phoenicurus frontalis*	BLFRE	Z
Bluethroat	*Luscinia svecica*	BLUET	Z
Blue-throated Barbet	*Megalaima asiatica*	BLTBA	BC
Brahminy Starling	*Sturnus pagodarum*	BRAST	AB
Brown Dipper	*Cinclus pallasii*	BRODI	AB
Brownish-flanked Bush	*Cettia fortipes*	BFBWA	Z

Species	*Scientific Name*	Species Code	Ring Size
Warbler			
Chestnut-crowned Laughingthrush	*Garrulax erythrocepahlus*	CHCLA	B
Chestnut-eared Bunting	*Emberiza fucata*	CHEBU	Z
Chiffchaff, Common	*Phylloscopus collybita*	COMCH	Y
Chiffchaff, Siberian	*Phylloscopus collybita tristis*	SIBCH	Y
Cinereous Tit	*Parus cinereus*	CINTI	Z
Citrine Wagtail	*Motacilla citreola citreola*	CITWA	Z
Collared Dove, Eurasian	*Streptopelia decaocto*	COLDO	C
Common Babbler	*Turdoides caudata*	COMBA	AB
Common Hoopoe	*Upupa epops*	COMHO	AB
Common Kestrel	*Falco tinnunculus*	COMKE	C
Common Myna	*Acridotheres tristis*	COMMY	BC
Common Quail	*Coturnix coturnix*	COMQA	B
Common Redshank	*Tringa totanus*	COMRE	B
Common Sandpiper	*Actitis hypoleucos*	COMSA	AA
Common Tailorbird	*Orthotomus sutorius*	COMTA	Z
Common Teal	*Anas crecca*	COMTE	C
Common Woodshrike	*Tephrodornis pondicerianus*	COMWO	A
Crested Kingfisher	*Megaceryle lugubris*	CREKI	C
Crested Lark	*Galerida cristata*	CRELA	Z/A
Daurian Shrike	*Lanius isabellinus*	DAUSH	A
Golden Bush Robin	*Tarsiger chrysaeus*	GOBRO	Z
Green-backed Tit	*Parus monticolus*	GRBTI	Z
Greenish Warbler	*Phylloscopus trochiloides*	GREWA	Y
Grey Bushchat	*Saxicola ferreus*	GREBU	Z

Species	*Scientific Name*	Species Code	Ring Size
Grey Francolin	*Francolinus pondericerianus*	GREFR	C
Grey Treepie	*Dendrocitta formosae*	GRETR	B
Grey Wagtail	*Motacilla cinerea*	GREWA	A
Grey-breasted Prinia	*Prinia hogsonii*	GRBPR	Z
Grey-headed Canary Flycatcher	*Culicicapa ceylonensis*	GHCFL	Z
Grey-headed Woodpecker	*Picus canus sanguiniceps*	GRHWO	B
Grey-hooded Warbler	*Seicercus xanthoschistos*	GRHWA	Y
Grey-sided Bush Warbler	*Cettia brunnifrons*	GSBWA	Z
Himalayan Bluetail	*Tarsiger rufilatus*	HIMBL	Z
Himalayan Bulbul	*Pycnonotus leucogenys*	HIMBU	AB
House Sparrow	*Passer domesticus*	HOUSP	A
Hume's Warbler	*Phylloscopus humei*	HUMWA	Y
Indian Robin	*Saxicoloides fulicatus*	INDRO	A/AA
Jungle Babbler	*Turdoides striata*	JUNBA	B/BC
Jungle Prinia	*Prinia sylvatica*	JUNPR	A
Kentish Plover	*Charadrius alexandrinus*	KENPL	AB
Lemon-rumped Warbler	*Phylloscopus chloronotus*	LERWA	Y
Lesser Whitethroat	*Sylvia curruca blythi*	LESWH	Z
Lesser Whitethroat, Hume's	*Sylvia curruca althaea*	HULWH	Z
Little Forktail	*Enicurus scouleri*	LITFO	Z
Little Ringed Plover	*Charadrius dubius*	LIRPL	AB
Long-billed Pipit	*Anthus similis*	LOBPI	A
Long-tailed Shrike	*Lanius schach*	LOTSH	AA
Mountain Chiffchaff	*Phylloscopus indianus*	MOUCH	Y

Species	*Scientific Name*	Species Code	Ring Size
Olive-backed Pipit	*Anthus hodgsoni*	OLBPI	A
Oriental Skylark	*Alauda gulgula*	ORISK	A
Oriental White-eye	*Zosterops palpebrosus*	ORWEY	Z
Paddyfield Pipit	*Anthus rufulus*	PADPI	A/AA
Peregrine	*Falco peregrinus*	PEREG	?
Pied Bushchat	*Saxicola caprata*	PIEBU	Z/A
Pied Kingfisher	*Ceryle rudis*	PIEKI	B
Pink-browed Rosefinch	*Carpodacus rodochrous*	PIBRO	A
Plain Prinia	*Prinia inornata*	PLAPR	Z/A
Plumbeous Water Redstart	*Rhyacornis fuliginosus*	PLWRE	Z
Puff-throated Babbler	*Pellorneum ruficeps*	PUTBA	A
Red-headed Bullfinch	*Pyrrhula erythrocephala*	REHBU	A
Red-vented Bulbul	*Pycnonotu scafer*	REVBU	AB
River Lapwing	*Vanellus duvaucelii*	RIVLA	C
Rock Bunting	*Emberiza cia*	ROCBU	Z
Rufous Sibia	*Heterophasia capistrata*	RUFSI	AB
Rufous Treepie	*Dendrocitta vagabunda*	RUFTR	C
Rufous-bellied Niltava	*Niltava sundara*	RUBNI	Z
Rufous-breasted Accentor	*Prunella strophiata*	RUBAC	Z
Rufous-gorgeted Flycatcher	*Ficedula strophiata*	RUGFL	Z
Russet Sparrow	*Passer rutilans*	RUSSP	A
Sand Lark	*Calandrella raytal*	SANLA	A
Scaly-breasted Munia	*Lonchura punctulata*	SCBMU	Z

Species	*Scientific Name*	Species Code	Ring Size
Scaly-breasted Wren Babbler	*Pnoepyga albiventer*	SBWBA	Z
Slaty-blue Flycatcher	*Ficedula tricolor*	SLBFL	Z
Small Minivet	*Pericrocotus cinnamomeus*	SMAMI	Z
Speckled Piculet	*Picumnus innominata*	SPEPI	Z
Speckled Woodpigeon	*Columba hodgsonii*	SPEWO	F
Spotted Dove	*Streptopelia chinensis*	SPODO	BC
Spotted Forktail	*Enicurus maculates*	SPOFO	AB
Stonechat, Common	*Saxicola torquata*	COMST	Z
Stonechat, Siberian	*Saxicola maurus*	SIBST	Z
Streaked Laughingthrush	*Garrulax lineatus*	STRLA	AB
Streak-throated Swallow	*Hirundo fluvicola*	STTSW	Z
Striated Prinia	*Prinia crinigera*	STRPR	Z
Tawny Pipit	*Anthus campesteris*	TAWPI	A
Temminck's Stint	*Ereunetes (Calidris) temminckii*	TEMST	A
Tree Pipit	*Anthus trivialis*	TREPI	Z
Ultramarine Flycatcher	*Ficedula superciliaris*	ULTFL	Z
Upland Pipit	*Anthus sylvanus*	UPLPI	A
Variable Wheatear	*Oenanthe picata*	VARWH	A
Variegated Laughingthrush	*Garrulax variegatus*	VARLA	B
Wallcreeper	*Tichodroma muraria*	WALLC	A
Whiskered Yuhina	*Yuhina flavicollis*	WHIYU	Z
Whistler's Warbler	*Seicercus whistleri*	WHIWA	Y
White Wagtail	*Motacilla alba*	WHIWA	A
White-capped Water Redstart	*Chaimarrornis leucocephalus*	WCWRE	A

Species	*Scientific Name*	Species Code	Ring Size
White-tailed Rubythroat	*Luscinia pectoralis*	WHTRU	Z
White-tailed Stonechat	*Saxicola leucurus*	WHTST	Z
White-throated Fantail	*Rhipidura albicollis*	WHTFA	Z
Wood Sandpiper	*Tringa glareola*	WOOSA	AA
Wryneck, Eurasian	*Jynx torquilla*	WRYNE	AA
Yellow-bellied Fantail	*Rhipidura hypoxantha*	YEBFA	Z
Yellow-billed Blue Magpie	*Urocissa flavirostris*	YBBMA	C
Yellow-eyed Babbler	*Chrysomma sinense*	YEEBA	A

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